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XXIX.—On *Deronectes depressus*, *Fab.*, and *elegans*, *Panzer*. By FRANK BALFOUR-BROWNE, M.A. (Oxon. et Cantab.), F.R.S.E., Lecturer in Entomology in the Department of Zoology, University of Cambridge; Staff Lecturer in Entomology in France; Capt. R.A.M.C.T. Reserve.

[Plates VII. & VIII.]

IN our standard work upon British beetles and in our catalogues there are five species of *Deronectes*, of which one is given as *Deronectes depressus*, F., sometimes with *elegans*, Panz., as a synonym.

Under this name we have two species mixed in our collections, and these two species, although easily confused, are really distinct, and with a little experience easily separated.

One of these is common throughout England and Scotland, while the other seems to be limited in its distribution, being confined, so far as I know at present, to Scotland and the north of England and to Ireland, where it is apparently the only one found. My uncertainty as to Ireland rests upon the fact that before I knew of the existence of these two species I had "*depressus*" in my records for most parts of that country—for twenty-four out of the thirty-eight county and vice-county divisions,—but I had actually kept very few specimens. These, however, all prove to be what I will call the northern species, and all other Irish specimens I have

since seen—a few in the Dublin Museum collection, a few in the Natural History Museum collection, some in the collection of Dr. G. W. Nicholson—belong to this species.

The discovery of the existence of this northern species in the British fauna I attribute to Dr. Sharp, although he tells me he remembers nothing about it and cannot now find in his collection the specimens which I thought I had seen there; but it was Capt. Ste. Claire Deville, of Epinal, France, who, in 1911, suggested to me the possibility of its existence in these islands. I had sent him a number of British water-beetles, and among them one or two English specimens of what I had named "*D. depressus*," and in acknowledging the receipt of them he said: "I agree with you for the names of all Dytiscidæ but *Deronectes depressus*, which seems to me to be our *D. elegans*, Sturm. The true *depressus*, an Arctic species, which I have from Russia, Norway, and also from Eastern Pyrenees, is perhaps also British" \*.

Later in the year I was in Brockenhurst, and I mentioned this matter to Dr. Sharp, who, as I think, agreed that our common form was "*elegans*," and showed me two rather large and dark specimens of *Deronectes* from some eastern Scottish locality—I think it was L. Brandy in Forfarshire—which he considered to be the "*depressus*" of Fabricius.

After casually looking through my specimens, and failing to recognize any differences among them, I let the matter drop until in July 1915 I came across a statement by Thomas Bold, who, speaking of *Hydroporus elegans*, Illiger, said:—"I take a strongly marked var. of this common insect in Talkin Tarn, Cumberland. At first sight they much resemble *H. 12-pustulatus*, being much larger and darker coloured than the specimens of *elegans* from running water. Some have the elytra wholly black, except a narrow yellow margin, others are more or less lineated with yellow, and scarcely any of them have the spotted appearance characteristic of the species." †. This re-aroused my interest in the subject, and, as I was just starting to motor to Scotland, I determined to make a slight detour so as to visit Talkin Tarn on my way. This small tarn lies about 9 miles east of Carlisle, at

\* Postcard, May 23, 1911.

† "Capture of some of the rarer *Hydropori* in the North of England," Zoologist, xii. pp. 4193-4196 (1854). Vide also *ibid.* xi. 1853, pp. 3924, 3925. Report of Proceedings of Tyneside Nat. Field Club Meeting, Mar. 30, 1853, where a large dark var. of *H. elegans*? from Talkin Tarn is mentioned.

about 400 feet above sea-level, and within 2 miles of the main road between Carlisle and Newcastle, so that it was not difficult to get at. The day of my visit was not propitious; it began to rain heavily just as I got to the tarn, and I spent a miserable fifteen minutes paddling about at the edge, during which time I collected five species of Hydradeephaga, and among the few specimens were two of Bold's "large and dark *elegans*."

On an examination of these a few days later, and on comparison with some freshly caught specimens from the Nith at Dumfries, I began to suspect that the Talkin Tarn individuals were the "*depressus*" referred to by Ste. Clair Deville, and I returned to the tarn and collected a number of specimens for further examination.

During August I examined a number of lochs and streams in the south of Scotland (Selkirk, Dumfries, Kirkcudbright, and Ayr), and definitely came to the conclusion that there were two species; but I was also greatly struck by the extraordinary distribution of the rarer one, which occurred in only a few lochs scattered about the district. Shortly after that, military duties, illness, and a long convalescence intervened, and it is only recently that I have again taken up the matter, and during August of last year I explored a number of the Galloway lochs with a view to further investigating the distribution there of the form which I take to be the *depressus* of Fabricius.

The characters upon which the two species can be separated are three in number: (1) the shape of the thorax in ♂ and ♀, (2) the form of the anterior tarsal claws of the ♂, and (3) the form of the œdeagus.

In general appearance the two species are usually very much alike, the colour-plan being similar, but, as a rule, the northern species is rather larger than the other. The range of colour-tone in the common species is greater than in the northern one, which is always dark, the yellow being reduced to a minimum, the black always occupying a large extent of the surface of the elytra. In the common species, especially in specimens from the south, the yellow is usually lighter in tone and the black more limited, but the relationship between the black and yellow seems to be related to habitat and to climatic conditions, as is the case with *Platambus maculatus*, *Deronectes griseo-striatus*, and some other Hydradeephaga. In the Scottish lochs I can find no difference whatever in colour-tone between the two species.



1. *The Thorax*.—To some extent the form of the thorax is of use as a discriminating character, although by itself it is of little value.

Comparing the males:—In the northern species the sides of the thorax tend to diverge, so that it is wider behind than in front, the greatest width being almost at the posterior angles. In the common species the sides of the thorax, although curved, run more or less parallel, the greatest width being some distance in front of the posterior angles.

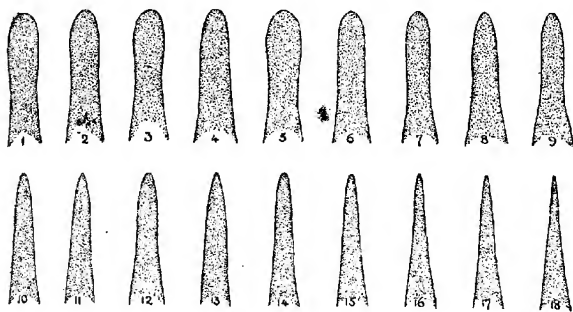
Comparing the females:—In the northern species the sides of the thorax are more or less parallel, so that it is about as wide, or very nearly as wide, posteriorly as anteriorly. Also the length in the median line from the anterior to the posterior edge is usually rather more than half the breadth at the broadest part. In the common species the sides of the thorax contract, so that it is distinctly narrower behind than in front, and the length in the median line is not quite half the breadth at the broadest part.

The form of the thorax is, however, not an entirely reliable character, as some males of the northern species are more parallel-sided, and some males of the common species, especially perhaps from some of the northern localities, have the thorax with at least a suggestion of greater width behind. In the females this character is even less reliable, which is specially unfortunate, since it is the best I can find, the female sexual armatures being quite similar. I will go so far as to say that the variation and overlapping of the two species in the form of the thorax in the female are such that I do not feel confident in determining the species from female specimens only. In three cases in which I had only females I named them tentatively. In two of these cases I later found males, and I happened to have been right in my determination, but I still feel that the female character is not reliable.

2. *The anterior tarsal claws of the males* form a useful character for distinguishing the two species. In the northern one these claws are usually much longer and the inner claw is much more strongly curved than in the common species. In both cases the curve is nearer the apex than the base, but the claw is more bent in the northern species, while in the common one the curve is gentle and regular. Whereas the outer (posterior) claw in the northern species is often slightly shorter than the inner (anterior) one, in the common species the two claws are more usually equal in length. The claw-

characters, taken in conjunction with the thorax-characters, generally enable one to separate the males with comparative ease, and so far, with one exception, I have always been able to determine the species on these characters, a subsequent examination of the ædeagus confirming my previous determination.

3. *The Ædeagus*.—In the northern species this organ, viewed from above, has a broad apex, while in the common form it has a pointed one, and until my recent visit to Gallo-way I regarded this character as definitely proving that we have two distinct species. On looking through my additional material from eighteen more lochs, I had no difficulty in separating the males of the two forms on the thoracic and



Apices of ædeagi of specimens of *D. depressus* ("the northern species") and *D. elegans* ("the common species"), chosen to show the range of variation.—Figs. 1-9. *D. depressus* (1, Talkin Tarn; 2, L. of the Lowes; 3, L. Urr; 4, L. Doon; 5-9, L. Dungeon). Figs. 10-18. *D. elegans* (10, 11, R. Spey; 12, 13, Long L. of the Dungeon; 14, L. Stroan; 15, L. Aber; 16, L. Skene; 17, Broadford River, Skye; 18, Moorlinch, N. Somerset).

tarsal claw-characters except in one case—Loch Dungeon, the specimens from which I put down as "uncertain." On examining the ædeagus of these specimens I found a range of width in the apex from that of typical "northern" specimens to a comparatively narrow and bluntly pointed form (*vide* figs. 5-9 *infra*).

Now I had previously noticed that there was a variation in

width in both species, but until I examined the Loch Dungeon specimens there was always a wide gap between the two types of ædeagus, the northern form being rounded at or even slightly flattened across the apex, and the common form pointed; and here, in specimens from this one loch, I found intermediates closing the gap. In the tarsal claw-character the males are mostly of the northern type, but in the shape of the thorax there is considerable variation. The females, too, are mostly what, in the absence of males, I should have left unnamed or put down very doubtfully as the common species.

The first explanation which will occur to anyone is that we have in Loch Dungeon a hybrid; but there are one or two objections to this view. In the first place, I did not find in the loch any male with an ædeagus of the normal "common species" type. The narrowest ædeagus is as broad as or broader than the broadest ædeagus of the common species (v. fig. 10), although the surrounding lochs contain the common species with a narrower ædeagus.

In the second place, if this loch contains hybrids, why does no other of the thirty-two lochs I have examined contain them? \* With one exception I have not found both species present together in any loch, and in the exceptional case—Loch Stroan—I only found a single male of the northern species, while the common one was abundant there.

It seems open to question, therefore, whether we have merely one species showing extreme range of form or whether we have two species very closely related to one another. On the evidence in my possession, *i. e.*, after examining considerably more than five hundred specimens, I am inclined to adopt the latter view, first, because the variation in the ædeagus does not overlap in the two forms, and connecting-links have so far only turned up in the one loch, and, secondly, because of the extraordinary distribution, isolation, and rarity of this northern one, to which I will refer in detail later on.

Having come to the conclusion that these are two distinct species, the question arises, are they, as has been suggested, the *depressus* of Fabricius and the *elegans* of Panzer, or is one of them something new? The most direct method of settling the question would have been by comparison with the types of the two species, and I had great hopes that the "*depressus*"

\* I have altogether examined forty-five lochs in southern Scotland, but seventeen of these contained neither species.

type might exist in this country. Fabricius, in his 'Entomologia Systematica,' frequently mentions where his type-specimens are to be found, but in the case of "*Dytiscus depressus*" he gives no such information; and an examination of the Banksian Collection in the Natural History Museum and of Graham Kerr's published list of Fabrician types in the Glasgow University Museum failed to discover its location. It is presumably in Copenhagen or some other Scandinavian museum if it is still in existence.

As to Panzer's type, I could get no information, and in the absence of the types I had to fall back upon the literature. I therefore started with Fabricius's Ent. Syst., and examined most of the important works from 1792 up to the present time, and I have looked up more than forty references in the course of this examination. Two points have struck me during this part of the work: one is the exceeding vagueness of the original descriptions, which give only colour-characters for the recognition of the species, and the other is that, where subsequent authors have treated *depressus* and *elegans* as distinct species, they have mostly shown an extraordinary lack of originality, relying, like their predecessors, mainly upon colour-characters and merely varying the words of the original descriptions.

I have included at the end of this paper a bibliography of the works I have looked up, with, in each case, a short note as to the view taken by the author, but a short *résumé* of some of the more important works may be of interest.

Fabricius's original description was published in 1792 and that of Panzer about 1793—Paykull, Illiger, and Marsham following in order of date. The first only refers to Fabricius's species, without giving any indication as to whether he knew *elegans*. Illiger describes the colouring of Panzer's species, and then says "the *D. depressus* appears to be closely related to this species," showing that he only knew the latter from a description.

How Marsham identified our common British species as *elegans* we have no means of knowing, but we can assume that either he did not know *depressus*, which seems probable, or that he regarded it as distinct from Panzer's species.

Dufschmidt seems to have been the first to regard "*elegans*" as a synonym of "*depressus*," though the remark he makes suggests that he possibly had the latter, since he mentions that whereas Panzer and Illiger describe their species as having the underside rusty red, his specimens have that part black.

From that time on the writers can be divided into those who regarded "*elegans*" as a synonym of "*depressus*" and those who recognized two distinct species. Among the former are Schonherr, Gyllenhal, Kunzé, Stephens, Zetterstedt, Wilson and Duncan, Aubé, Schiödte, Schaum (1868), and Sharp.

So far as I can make out, Stephens has merely followed Kunzé, since in his later work (1829) he gives the species as "*depressus*, Kunzé." Aubé regards individuals with the black reduced as *elegans*, Sturm, and his long description is mainly a colour one. Schaum, in an earlier paper (1843), regarded *elegans* as a distinct species, and he mentions its occurrence in salt lakes in Saxony, refers to the synonymy, and points out the longer form and darker underside of "*depressus*, F., Gyll., Sahlb., and Sturm, and also refers to the distribution of this latter species, which, he says, appears to be indigenous to Finland, Sweden, Denmark, and Kief (Mid-Russia), *elegans* being found throughout Mid and South Germany, France, and Switzerland. In 1868, however, he alters his opinion, giving "*elegans*" as a synonym of "*depressus*," but remarking that Swedish examples ("*H. depressus*, Gyll.") are longer and darker than the German ones.

Sharp, in his 'Dytiscidæ,' says nothing about *elegans*, and gives what is mainly a colour-description of "*Dytiscus depressus*, Fab." His types (no. 241. 1 ♂ and 1 ♀ "*Anglia*" and 1 ♀ "*Europa*"), in the Natural History Museum, are, however, our common species, and I have therefore concluded that he regarded "*elegans*" as a synonym of "*depressus*."

Among those who regard *elegans* as a distinct species we find Sturm, Murray, Bach, Bosé, Seidlitz, Ganglbauer, Everts, and Reitter, while we may perhaps include the Sahlbergs and Thomson, who only describe *depressus*, but from a region where *elegans* would be less likely to occur.

Sturm makes three species out of his material, calling his new one "*brevis*," but, according to Schiödte, he admits that he has only seen a single specimen of the northern *depressus*, and his descriptions, beyond referring to minute differences in form, only deal with colour-characters. Subsequent authors have regarded his "*brevis*" as a synonym of "*elegans*."

In his 'Icones' on pl. cciii. he has a typical *elegans* labelled "*H. depressus*," which he explains is a mistake for "*H. brevis*." On pl. ccv. he illustrates "(A) *H. elegans*, Illig.,"

and "(B) *H. depressus*, Gyll." The sex of the individuals drawn is not mentioned, but by the shape of the thorax A is more like *depressus*, while the dark colouring of B agrees with his description of that species, the shape of the thorax in his drawing suggesting either a ♀ *depressus* or a ♂ *elegans*.

Murray gives *H. elegans*, Illiger, as our British species, with the synonyms "*depressus*, Aubé, Steph., not Fab., *brevis*, Sturm," and this elimination of Fabricius's species as something distinct is interesting. Further, his synonymy shows that he regarded Aubé and Stephens as wrong in their species.

Bach's remarks are of interest mainly because of what he says as to the habitat of *elegans*. He describes *depressus* as very rare, while *elegans*, he says, occurs in the salt lake at Eisleben, a statement which agrees with Schaum's observations at Sülldorf and Stassfurth, also in Saxony but a little farther north. For a species which elsewhere occurs in lakes and rivers this habitat is remarkable, but we find other Hydradeephaga and Hydrophilidæ showing similar peculiarities—in fact, several at least of our brackish-water beetles are freshwater species in the Mediterranean district.

Seidlitz for the first time gets off the beaten track, and about ninety years after the discovery of the two species finds reliable characters upon which they may be separated. He refers to the different forms of the two insects, mentioning the thorax, and he also mentions the difference in form and size of the anterior tarsal claws of the males; and from his description, which has been enlarged upon by Ganglbauer, I regard our northern species as his "*depressus*" and our common one as his *elegans*.

In a footnote (1886, p. 57) he states that Sturm was the first to separate the two species, and that the earlier writings of Panzer and Illiger refer to *depressus*. Undoubtedly Sturm is the first author to refer to both and to describe them as separate species, but I can find no evidence for the statement as to Panzer and Illiger. So far as colour is of any value as a discriminating character, it is quite evident that Panzer is referring to lighter-coloured specimens than Fabricius, and from the chain of evidence which I have outlined I regard *elegans* as his species.

#### *Habitat and Britannic Distribution.*

So far as habitat is concerned, *D. elegans* is a river and loch species in our islands, whereas, omitting Ireland, which

requires further investigation, *D. depressus* is apparently only a loch species.

The same type of loch suits both, and they occur upon a stony, gravelly, or sandy bottom, but apparently not on a peaty one. Some sort of vegetation seems to be necessary, but whereas in some lochs I found the beetles on ground carpeted with *Lobelia dortmanni*, in others this weed failed to produce any. The most fertile spot was usually where there was a patch of *Myriophyllum* or other weed on a stony bottom, but even such a place sometimes failed to produce a single individual.

I examined seventeen lochs without finding either species, and the following is a list of these:—

* "Upper Loch," Lochmaben. Dumfries.	
Clearburn L.	Selkirk.
L. Smaddie.	Kirkcudbright.
L. Lurkie.	
L. Arthur or Lotus L.	Kirkcudbright.
Knocksting L.	"
Lochenbreck L.	"
Little Dornell L.	"
Blates Mill L. (by Woodhall L.).	Kirkcudbright.
Dry Loch (Dungeon of Buchan).	"
L. Dow (Craigshaw).	"
Craiglee L. (top of Craiglee).	"
Long L. of Glenhead.	"
L. Minnoch.	"
L. Enoch.	"
L. Arron.	"
L. Neldricken.	"

In the case of one or two of these the peaty bottom perhaps made the habitat unsuitable (e. g., Little Dornell L., Blates Mill L., and "Upper" L.), while in others perhaps altitude excluded them (e. g., L. Enoch, 1600 ft.; L. Arron, 1400 ft.; Craiglee L., 1700 ft.; and L. Dow, 1300 ft.), but in the case of most of the others I cannot imagine why I found neither species, except that I was unlucky. Why, for instance, should L. Neldricken not have either of them, when both L. Valley and L. Narroch possess *elegans*? The Long L. of Glenhead is to all appearance quite as suitable for the species as the Round L., which contains *elegans*. Knocksting L. and L. Arthur I worked thoroughly and over very promising ground, and yet without result. L. Minnoch, lying between Lochs Harrow and Dungeon, I worked three times, and examined it all round, and yet failed to find any water-beetle at all. Such a result is very rare in my experience. Lochen-

breck L. being the only other loch in the list which gave a like result.

Seeing that *D. depressus* is a northern species, I certainly expected to find it at higher altitudes than *D. elegans*, and yet, whereas the latter occurred in several lochs above the 1000-foot line, usually with the true "Arctic" species *D. griseo-striatus*, the former was in no loch above this level—in fact, excepting L. Dungeon, which is about 1000 feet above the sea, all the other lochs in which it occurred are at a much lower altitude.

The habits of the two species seem to be identical. In some places the beetles occur in shallow water at the side, so that they can be caught without one having to take off shoes and stockings, while in other places the only way to get them is to strip and go in almost to the waist. In one part of L. Doon, for instance, I got a few specimens in about 2 feet of water, but none closer in, whereas in another part I failed to get any until I scraped about in the shallowest places. In Loch Dungeon I caught a single specimen in the shallows, and then found them in abundance in a place where the gravel suddenly sloped downwards into deep weedy water. In Loch Narroch I got nothing until I stripped and went in, and then I found plenty of specimens in 3 to 4 feet of water. Again, in Loch Ken, wading to the knees enabled me to obtain a dozen and more specimens within five minutes.

Possibly, of course, the beetles vary their depth at different times, and the same place in a loch might yield quite different results at different hours or on different days; but I have not yet investigated this point, and am merely recounting my experiences in obtaining my material.

With regard to the Britannie distribution of the two species, I have already mentioned that apparently only *D. depressus* occurs in Ireland, and I have in my collection or have seen specimens from Antrim, Fermanagh, Cavan, Sligo, and Cork West. In Britain the only counties in which I have so far taken this species are Cumberland, Selkirk, Dumfries, Kirkcudbright, Ayr, and perhaps Dumbarton (Loch Lomond); but in the latter case I have only a female specimen, and, as I have said, I do not feel quite certain as to the species in the absence of a male.

Of the thirty-two lochs examined in which one or other of the two species occurred, *depressus* was only found in eleven, and the following is a list of these:—

Talkin Tarn.	Cumberland.
St. Mary's Loch.	{ Selkirk.
L. of the Lowes.	{



L. Urr.	Dumfries and Kirkcudbright (specimens taken in various parts of the loch).
L. Roan.	Kirkcudbright.
L. Ken.	"
L. Dungeon.	"
L. Stroan (1 only).	Kirkcudbright.
L. Dornell.	"
Woodhall L.	"
L. Doon.	Ayr.

With the exception of L. Stroan, where only one specimen (♂) occurred amongst many *elegans*, these lochs, scattered over a large district, were occupied by *depressus* to the entire exclusion of *elegans*. In some, e. g., Talkin Tarn, L. of the Lowes, L. Roan, and L. Ken, it was abundant and easily taken, whereas in others an hour or more was necessary to get sometimes only a few specimens.

A glance at the Ordnance Map will show the extraordinary nature of this distribution. In the Merrick and Kells district, out of thirteen lochs examined only one (L. Dungeon) gave me this species, while seven gave me *elegans*. Why should Lochs Urr, Ken, Roan, Woodhall, and Dornell contain *depressus*, when Howie, Skerrow, Auchenreoch, Milton, Lochrutton, Aber, and Kinder contain *elegans*, or why should St. Mary's L. and the L. of the Lowes have the former, while L. Skene, an "Arctic" loch dammed up by moraine material, only contains the common species?

If *depressus* occurred in such lochs as Enoch and Skene, we could quite easily account for its distribution, on the ground that it is a remnant of the old fauna of the Glacial Period still holding on in a few isolated habitats; but its "spotty" distribution and its isolation from *elegans* are facts as to the explanation of which I can at present make no guess. When things once more settle down to their normal, I hope to further investigate the matter and to follow out the life-histories of the two species, from which, perhaps, something may be learnt.

The common species, *elegans*, is undoubtedly much more widely distributed than my records indicate; but this is not the time to worry other Coleopterists to send me their specimens for examination, so that I have been limited in material almost to what I have collected myself. I have in my collection or have seen specimens from the following counties and vice-counties:—Cornwall, W.; Devon, S.; Somerset, N. and S.; Hants, S.; Kent, E. and W.; Middlesex; Bucks; Herts; Cambs; Norfolk, E.; Suffolk, E.; Cumberland; Isle of Man; Dumfries; Kirkcudbright; Lanark; Renfrew; Peebles; Edinburgh; Mid-Perth; Easternness and Ebudes N.

I have records for *depressus*, Brit. auct., for 43 out of the 70 English and for 21 out of the 41 Scottish county and vice-county divisions, and it is most probable that the majority of these refer to *elegans*, which is almost certainly a typical "British" species in Watson's sense of the term\*.

With regard to the distribution of this species in the southern Scottish counties, it occurred in the following twenty-one lochs:—

L. Ettrick.	Dumfries.
L. Skene.	"
Castle L.	} Lochmaben, Dumfries.
Kirk L.	
Mill L.	
Hightae L.	
L. Kinder.	Kirkcudbright.
Lochrutton L.	"
Milton L.	"
Auchenreoch L.	"
L. Aber.	"
L. Howie.	"
L. Struan.	"
L. Skerrow.	"
L. Dee.	"
Long L. of the Dungeon.	Kirkcudbright.
Round L.	" " "
L. Narroch.	Kirkcudbright.
L. Valley.	"
Round L. of Glenhead.	Kirkcudbright.
L. Harrow.	"

In Cumberland the only loch I examined other than Talkin Tarn was Tindale Tarn, about 3 miles distant, and there this species occurred commonly.

So far I have not found *depressus* in any British stream, but if it occurs in Irish rivers—a point not yet determined, as all my Irish specimens are from lochs and canals—it may perhaps also occur in Scottish ones.

I have, or have seen, river specimens of *elegans* from the Nith, Dumfries; Spey, Easternness; Broadford R., Skye; Almond R., Mid Perth; and the Water of Leith, Edinburgh. These river specimens are always more brightly coloured than loch specimens, and I think I should not hesitate to determine female river specimens of *elegans* even in the absence of males. However, if *depressus* also occurs in some rivers it may have brightly coloured individuals also.

Much remains to be done on the economy of these two

\* 'Cybele Britannica, or British Plants and their Geographical Relations,' 1847.

species, but, as further investigations must be postponed indefinitely in these moving times, I have thought it well to put on record the existence of this additional species in the British beetle fauna, together with the notes I have made up to date.

#### Summary.

There are apparently two species included by British authors under the name *Deronectes depressus*. One of these I regard as *D. depressus* of Fabricius and the other as *D. elegans* of Panzer.

The characters upon which these species may be separated are :—

1. The shape of the thorax in ♂ and ♀. By itself this is of little value, especially in the ♀, and in the latter sex there is, unfortunately, no other means of separating the species except by size, which, of course, is equally unreliable.
2. The anterior tarsal claws of the ♂, a character which, in conjunction with the shape of the thorax, makes the separation of the species easy in most cases.
3. The breadth of apex of the ædeagus. This varies in both species, and the variation is such that the narrowest ædeagus of *D. depressus* and the broadest of *D. elegans* are almost alike.

This discovery of a complete series from broad- to narrow-apexed ædeagus (*vide text-figures*) made me doubtful as to the specific distinctness of the two forms, but, having regard to the fact that the two species do not occur together, that the distribution of *depressus* in the district examined is limited to eleven out of thirty-two lochs and that these eleven lochs are scattered about in the district, I continue for the present to regard the two as good species very closely related to one another.

A short historical review of the two species is given, and a bibliography of the more important works referring to them.

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2. —. 1838. Species général des Hydrocanthares et Gyriniens, pp. 506, 507. [*elegans* a synonym.]
3. —. 1863. Cat. des Coléoptères de France, p. 11. [*elegans*, III, a synonym.]

4. BACH, 1854-60. Käfer Fauna für Nord u. Mittel Deutschland, &c., p. 109. [*elegans* a distinct species.]
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16. —. 1841. Fn. Coleoptera Helvetica, part i. p. 152. [*H. depressus*, F., Stm., Aubé, and Gyll. The inclusion of Aubé indicates that he regards *elegans* as a synonym.]
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20. MARSHAM, T. 1805. Ent. Brit. i. pp. 421, 422. [*elegans* only.]
21. MURRAY, A. 1863. Cat. Col. Scotland, p. 18. ["*H. elegans*, Illig. (*depressus*, Aubé, Steph., not Fabr.—*brevis*, Sturm)."]
22. PANZER, G. W. F. 1793 *et seq.* Fn. Insectorum Germaniae initia, or Deutschlands Insecten, Coleoptera, xxiv. 5. [*Dytiscus elegans*, original description.]
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32. SCHÖNHEIMER, C. J. 1806. Synonymia Insectorum. [*elegans* synonym.]
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34. —. 1891. Fn. baltica, ed. 2, pp. 80, 81. [*elegans* a distinct species.]
35. SHARP, D. 1882. "Dytiscidæ" (Trans. Roy. Dublin Soc. ii. ser. 2), p. 427. sp. 472. [*depressus*, F. No synonym.]
36. STEPHENS, J. F. 1825. Ill. Brit. Ent. Mand. ii. p. 51. [*elegans* a synonym.]
37. —. 1829. Cat. of Insects, i. Mand. p. 44. [*depressus*, Kunze, and *elegans* a synonym.]
38. STURM, J. 1835. Deutschland Fn. ix. pp. 7 et seq. [3 spp., *depressus*, *elegans*, and *brevis*.]
39. —. 1877. Icones Coleopterorum Germaniæ (plates cciii. & ccv.).
40. THOMSON, C. G. 1859. Skandinaviens Col. ii. p. 19. [*depressus* only.]
41. WILSON, J., & DUNCAN, J. 1834. Entomologia Edinensis, p. 120. [*elegans* a synonym.]
42. ZETTERSTEDT, J. W. 1828. Fn. Insectorum Lapponica, p. 225. [*elegans* a synonym.]

EXPLANATION OF THE PLATES.

PLATE VII.

- Fig. 1. Drawing of *Deronectes depressus*, F., ♂. Talkin Tarn, Cumberland.
- Fig. 2. Drawing of *Deronectes depressus*, F., ♀. Talkin Tarn, Cumberland.
- Fig. 3. Drawing of *Deronectes elegans*, Pz., ♂. R. Cam, Cambridge.
- Fig. 4. " " " ♀. " "

PLATE VIII.

- Fig. 1. Right anterior tarsal claws of ♂ *D. depressus*, F. Talkin Tarn, Cumberland.
- Fig. 2. Ditto, ditto. Loch of the Lowes, Selkirk.
- Fig. 3. Ditto, ditto. Lagan Canal, Co. Antrim.
- Fig. 4. Right anterior tarsal claws of ♂ *D. elegans*, Pz. Round L. of Glenhead, Kirkcudbright.
- Fig. 5. Ditto, ditto. Auchencroch L., Kirkcudbright. (Note the inequality of the claws in this case, which is exceptional.)
- Fig. 6. Lateral view of ædeagus of *D. depressus*, F.
- Fig. 7. Dorsal view of ædeagus of *D. depressus*, F.
- Fig. 8. Dorsal view of ædeagus of *D. elegans*, Panz.

Drawings of the tarsal claws are all to the same scale.

XXX.—On the Geographical Distribution of the Genus *Cosmophila*, a Noctuid of the Family Gonopteridæ. By Colonel C. SWINHOE, M.A., F.L.S., &c.

[Plates IX. & X.]

### Family Gonopteridæ.

#### Genus COSMOPHILA, Boisd.

Faun. Ent. Madagascar, p. 94 (833).

Type, *xanthindyma*, Boisd. l. c.

A very interesting genus, well worth careful investigation. Heretofore, on account of the similarity of pattern, authors have put all the different forms from America to Australia, regardless of the localities, mostly under the American form *erosa*; in 'Moths of India,' ii. p. 411 (1894), Hampson puts *xanthindyma*, Boisd., from Madagascar, *indica*, Guen., from India, *auragoides*, Guen., from Natal, *variolosa*, Walker, from North India, and *edentata* from Queensland all as synonyms of *erosa*, Hübner, from America.

Staudinger, in his Catalogue, 1901 edition, puts *xanthindyma*, *indica*, and *auragoides* under the American form.

Warren, in Seitz's 'Macrolepidoptera of the Palearctic Region,' vol. iii. p. 359 (Nov. 1913), puts *auragoides*, *variolosa*, and *edentata* as synonyms with *xanthindyma*; under *erosa* he puts *indica*.

The superficial pattern of all these is more or less the same, but there are differences. I could not get myself to believe that, notwithstanding the geographical distances, they could all be one and the same species, and consequently I got the Rev. C. R. N. Burrows, who is an expert on the genitalia of Lepidoptera, to examine specimens from many different parts of the globe, and I am very grateful to him and to Mr. F. N. Pierce of Liverpool for the pains they have taken in the matter. All the Plates are from drawings by Mr. Burrows, and all the notes on the genitalia are his, many of them having been submitted to Mr. Pierce for verification.

Mr. Burrows says that the dissections show a relationship to the Erebusidæ, to the genera *Argiva* and *Patula* in the large extensile *costata*, dorsal of the valves; he further

says, "I am thinking much of the *Gnathos* in your Noctuae; this forms quite a feature, locates them in the direction of the Geometrae, removes them from the bulk of the Noctuae, and it is remarkable that the species which occur in Britain should be so selected that all (except *Brepheos*) should lack this feature."

The examination of the genitalia divides all those that have been dissected into six groups, as follows:—

1. *Cosmophila erosa*, Hübner, Zutr. Samml. exot. Schmett. ii. p. 19, figs. 287, 288 (1810).

*Hab.* America.

*Valves* wide compared with length.

*Harpe* soft and spined.

Costal arms very thin, scale-like.

*Anellus*\*, lateral arms smooth, not knobbed.

*Coremata* very small and slight, single.

*Penis* short and broad, cornutus delicate.

The stiffening of the eighth abdominal segment very slight. (Pl. IX. fig. 1.)

Caracas, Venezuela, Jalapa (Mexico), Newcastle (Jamaica), Sapucay (S. America).

2. *Cosmophila xanthindyma*, Boisd. Faun. Ent. Madagascar, p. 94, pl. xiii. fig. 7 (1833).

*Cosmophila auragoides*, Guen. Noct. ii. p. 397 (1852).

*Harpe* well developed on valve, rigid.

Costal arms not evident.

*Anellus* very pronounced, lateral arms solid, rigid, knobbed.

*Coremata* very voluminous, single.

*Penis* long and narrow, cornuti scarcely evident. (Pl. IX. figs. 2, 3.)

Dar-es-Salam, Karachi.

3. *Cosmophila edentata*, Walker, xi. p. 750 (1857).

*Harpe* soft and spined.

Costal arms rigid, slightly hooked.

\* Passage through which the penis passes.

*Anellus* very pronounced, lateral arms smooth, knobbed, decorations large and continuous.

*Coremata* double. (Pl. IX. fig. 4.)

Queensland, Australia.

4. *Cosmophila lyona*, nov.

*Harpe* soft and spined.

Costal arms rigid, hooked.

*Anellus* pronounced, lateral arms smooth, not knobbed.

*Coremata* double, very voluminous.

*Penis* stout, one large *cornutus*. (Pl. X. fig. 5.)

Padang (Sumatra), Ternate (Moluccas).

5. *Cosmophila indica*, Guen. Noct. ii. p. 396 (1852).

*Cirædia variolosa*, Walker, xi. p. 750 (1857).

*Harpe* soft and spined.

Costal arms strong, hooked.

*Anellus* with the arms smooth and straight.

*Coremata* double.

*Penis* very stout. (Pl. X. fig. 6.)

Assam, Bombay, Gooty, Palni Hills, S. India.

6. *Cosmophila dona*, nov.

*Anellus* very large, the valves without armature and angled (which is not the case in any of the others).

*Coremata* double, very voluminous.

The eighth segmental plate of the abdomen is reduced to a bar.

*Penis* narrow, *cornuti* scarcely evident (the penis is entirely different from any of the others). (Pl. X. fig. 7.)

Roeburne, Sherlock River, Australia.

1. *Cosmophila erosa*, Hübner, Zutr. Samml. exot. Schmett. ii. p. 19, figs. 287, 288 (1810).

Uniformly larger than the Old-World species; wings yellower, fore wing fairly uniform in colour throughout, the outer portion sometimes slightly darker than the inner; transverse lines and bands of the usual pattern, but very little



darker than the ground-colour; hind wing uniformly pale greyish ochreous without markings.

I have many examples from Venezuela, Mexico, S. America, and Jamaica.

2. *Cosmophila xanthindyma*, Boisd. Faun. Ent. Mad. p. 94 (1833).

A darker insect, transverse lines more or less similar; the outer portion of the fore wing (nearly the half) nearly always suffused with chocolate-brown; hind wing grey, generally dark grey on the outer portion.

*Hab.* Madagascar, Africa.

3. *Cosmophila edentata*, Walker, xi. p. 750 (1857).

The discal line of the fore wing is nearly straight and at its upper end is widely apart from the antemedial line; the upper part is bent inwards to the costa; the stigma in the cell is pure white and circular and isolated.

*Hab.* Queensland, Australia.

4. *Cosmophila lyona*, nov.

♂ ♀. Fore wing markings much as in *edentata*, colour paler and yellower; the discal line, however, is not nearly straight as in that species, but is angled inwardly at its middle; the genitalia in some respects are similar, but differ in the formation of the anellus; the decorations are small and bilobed, the armature of the valve is not quite the same, the eighth segment of the abdomen is much the same; the *penis* differs somewhat, being stronger than that of *edentata*, and both are entirely different from those of the other groups.

Expanse of wings, ♂ ♀,  $\frac{1}{10}$  inch.

*Hab.* Padang, W. Sumatra.

5. *Cosmophila indica*, Guen. Noct. ii. p. 397 (1852).

*Cirradia variolosa*, Walker, xi. p. 750 (1857).

♂ ♀. Generally a smaller insect than *xanthindyma*; the colour of the fore wing is brighter yellow, the discal band is more uniform, and the hind wing is yellowish white, generally quite uniform in colour. Guenée's type is from

"India," Walker's type N. India; it is a common form in the Khasia Hills and in Southern India.

*Hab.* N. India, Assam, Bombay, Gooty, Palni Hills, S. India.

#### 6. *Cosmophila dona*, nov.

♂ ♀. Of a uniform dark lilacine-grey colour: fore wing covered with minute darker grey striations; markings chocolate-brown; a short transverse line across the median vein one-third from the base of the wing, indications of its continuance at the costa, where there are also two very minute black dots; a mark at the end of the cell, a line below it followed by a large square cluster of chocolate dots, its outer portion having a line above it which does not reach the costa and has another cluster of dots outside it; some very minute black dots between these clusters and the outer margin; cilia concolorous with the wing, with deep black spots at the interspace-ends: hind wing dark grey, with the outer portions with darker suffusion; cilia white; palpi ochreous grey, whitish beneath; head and body concolorous with the wings. Underside uniform pale grey, rather pale on the hind wing; pectus and sides of the abdomen whitish; the female has only very faint indications of the markings; the angle in the middle of the outer margin of the fore wing is very slight.

Expanse of wings, ♂ 1, ♀  $1\frac{2}{10}$  inch.

*Hab.* Roebourne, W. Australia.

By the genitalia it is obviously a very distinct species, almost worthy of a separate genus, but the general build in so many other respects denotes close affinity.

#### 7. *Cosmophila milva*, nov.

♂. Fore wing ochreous-fawn colour, irrorated with very minute grey atoms; transverse lines brown, first subbasal sinuous, double; second antemedial, not sinuous, angled outwards on the median vein; third postmedial, straight from the hinder margin to near the upper end of the cell; fourth from a white costal spot, halfway between the third line and the outer margin, is slightly bent outwards near the costa, then nearly straight to vein 4, where it is angled outwards, then turns inwards on to the next lower vein, some dark shading outwards containing a slightly darker sinuous transverse band which gradually fades away hindwards; cilia

dark brown: hind wing ochreous grey, outer marginal line brown; cilia whitish, with brown tips: palpi brown; body concolorous with the wings. Underside uniform pale ochreous brown; hinder marginal space of fore wing pale, an outwardly curved brown line like a half-circle from the costa before the apex, and an outwardly curved discal line on the hind wing.

Expanse of wings, ♂,  $1\frac{3}{16}$  inch.

*Hab.* Gilolo Isl., North Moluccas (*Doherty*).

XXXI.—*New Lycenids and Hesperids and Two new Species of the Noctuid Family Acontiidae.* By Colonel C. SWINHOE, M.A., F.L.S., &c.

#### Family Lycenidæ.

##### *Lycænopsis trita*, nov.

♂. Upperside cerulean-blue, similar in colour to *L. ladonides*, de l'Orza\*, which it very much resembles; marginal lines of both wings black; cilia white. Underside cream-white, with a few blue irrorations at the base of both wings and along the abdominal margin of the hind wing: fore wing with a pale brown lunule closing the cell; five discal linear brown marks, four in a line, the upper one subcostal and well inwards; a double series of pale brown marks on the outer margin, the inner series lunular, the outer composed of triangular spots: hind wing with the outer margin similarly marked; a pale brown line closing the cell, a black spot on vein 6 near the base, and one below it in the cell, near the origin of vein 2; a subcostal black spot near the apex of the wing; a curved series of black spots in interspaces 4, 3, 2, and 1, two close together and well outwards in the interno-median interspace, and three black spots on the abdominal margin. Antennæ black with white rings; head and body above blue-black, white on the underside, head with black and white stripes; eyes ringed with white; palpi

\**Lep. Japan*, p. 20 (1869).

brown above, white beneath; legs brown above, white beneath; tarsi brown, with white rings.

Expanse of wings, ♂,  $1\frac{3}{10}$  inch.

Hab. Murree, N.W. Himalayas; two examples.

*Tajuria drucei*.

*Tajuria drucei*, Swinhoe, Lep. Indica, ix. p. 107, pl. 728. figs. 4, 4a, ♂ (1910).

♀. Upperside coloured like the male, but somewhat paler. Fore wing with the costal and outer marginal black band narrower: hind wing with the costal space blackish; a submarginal lunulate brown line and marginal square black spots, decreasing in size upwards; a black marginal line and a round black spot in the anal lobe; cilia of both wings white. Underside as in the male.

Expanse of wings, ♀,  $1\frac{3}{10}$  inch.

Hab. Shan States, Haipau. Both sexes received.

Superficially much like *T. jehana*, Moore.

*Ruralis pavo*.

*Zephyrus pavo*, de Nicé. P. Z. S. 1887, p. 460, pl. xl. fig. 11 ♀; id.

Butt. of India, iii. p. 309 (1890); Elwes, P. Z. S. 1892, p. 635.

*Ruralis pavo*, Swinh. Lep. Indica, viii. p. 279, pl. 705. figs. 1, 1a, 1b (1910).

♂. Upperside metallic green: fore wing with the costal line black, outer marginal band also black, moderately broad and even: hind wing with the costal space broadly black, outer marginal band evenly black, abdominal fold grey inwardly suffused with black. Underside silvery grey, markings chocolate-brown: fore wing with a thin costal band; a thick bar closing the cell; a broad discal band from the costa to vein 2, narrows gradually hindwards, its inner edge close to the discoidal bar; a submarginal thin band: hind wing covered with pale bluish irrorations, especially on the basal half; a discal band, broad on the costa, runs along it on each side, narrows hindwards, its outer edge angled on the veins, extends to near the anal angle, where it runs acutely inwards to the abdominal margin; two short costal marks between this band and the base of the wing; a thin submarginal lunular band, which curves inwards above the anal angle, outwardly deeply lined with orange, which

runs into the anal and subanal black spots; both wings with an anteciliar line.

Expanse of wings,  $1\frac{3}{10}$  inch.

*Hab.* Simla; also recorded from the Naga Hills, Upper Assam, and Bhutan.

De Nicéville described a female from Buxar Bhutan, and states that Doherty took a male near Margherita in Upper Assam at 400 feet elevation which agrees closely with his female type, and suggests that his own type may also be a male; but his figure is evidently that of a female, and Elwes says he has little doubt that Doherty's specimen (which he had before him) is a female also; my example is an undoubted male from Simla which on the underside is somewhat similar to de Nicéville's figure, but on the upperside is of the usual bright green colour so universal in the allied forms, with a black marginal border to both wings much as in *R. syla*, Kollar.

#### Family Hesperidæ.

##### Genus QUEDARA, nov.

♂. Antennæ more than half the length of the costa of fore wing; club long, terminating in a short thin point. Fore wing with the costa slightly curved, wing narrow, apex subacute, outer margin concave, of the same length as the hinder margin, which is straight; cell more than two-thirds the length of the costa; upper discocellular short, outwardly oblique, middle and lower discocellulars in nearly a straight line and of equal length; vein 2 from before the middle of the cell, 3 and 4 from the end, 5 from the middle of the two lower discocellulars; hind wing with the costa and outer margin in an even curve, the wing rather narrow across; vein 2 from close to the end of the cell, 3 and 4 from the end; discocellulars faint, angled inwards in the middle; vein 5 absent, 7 from one-fourth before end of cell, 8 curved from base to the apex of the wing. Palpi porrect, densely covered with hairs, last joint minute and pointed; hind tibiæ with two pairs of spurs; a pair of thick tufts of hairs standing up behind the collar.

Type, *comoptea*, nov.

*Quedara comoplea*, nov.

♂. Of a uniform dark violet-brown colour without any markings; the underside is slightly paler than the upperside, with the hinder marginal space of the fore wing palest.

Expanse of wings, ♂,  $1\frac{1}{8}$  inch.

Hab. Kina Balu, N. Borneo.

I place it in the section *Plastingiinae*.

Genus *ARUNENA*, nov.

♂. Antennæ about two-thirds the length of the costa of fore wing; club fine, bent at about a right angle; palpi sub-erect, very short, very hairy, pressed close against the face, third joint minute. Fore wing short, costa slightly arched, outer margin convex, not nearly so long as the hinder margin, which is straight; cell broad, a little more than half the length of the wing; vein 2 from one-third before end of cell, 3 and 4 from the end; discocellulars erect, the upper very minute, the others of equal length, vein 5 from their junction, veinlet in cell in continuation; vein 12 reaches costa well before end of cell: hind wing evenly rounded, vein 2 one-fourth before end of cell, 3 and 4 from the end, discocellulars and vein 5 not visible, 7 from a little before the upper end of the cell, 8 curved from base to apex of the wing. Hind tibiae with two pairs of spurs.

Type, *nigerrima*, nov.

*Arunena nigerrima*, nov.

♂. Of an uniform very dark black colour without any markings; the underside is as dark as the upperside; the hinder marginal space of the fore wing is broadly pinkish grey.

Expanse of wings, ♂,  $1\frac{1}{8}$  inch.

Hab. Khasia Hills, Assam.

I put this genus in the group *Astictopterinae*.

Family Acontiidae.

*Maurilia gilva*, nov.

♀. Fore wing dark rufous; a square orange patch at the

middle of the costa intersected by a brown line and surrounded by dark brown suffusion, two small round orange spots in the suffusion near the lower outer end of the square patch; transverse lines dark brown, the first subbasal, the second and third antemedial, somewhat close together and parallel with each other, very sinuous, ending outwards to the middle of the hinder margin, the outer one at its upper end edging the inner side of the square orange patch; two similar lines from the costa beyond the middle to the hinder margin near the hinder angle, the upper portion of the inner one edging the small round orange spots; a short pale brown band on the costa near the apex of the wing, which is attached to a broader pale brown marginal band which narrows hindward to a point at the hinder angle; cilia dark brown: hind wing grey, whitish at the costal space, the outer margin suffused with brown; cilia grey. Palpi, head, and thorax brown, the fore part of the thorax with ochreous hairs, the first two joints of the palpi with a white line beneath; abdomen dark grey. Underside: body and wings grey, the cell-space of the fore wing suffused with brown; pectus white.

Expanse of wings, ♀,  $1\frac{2}{16}$  inch.

*Hab.* Cape York.

Resembles *M. fortis* \* *mili*, from New Guinea, but is much smaller, the orange patch of the fore wing is differently shaped, and the outer transverse lines are different.

#### *Acontia elima*, nov.

♀. Fore wing milk-white with very minute chocolate-coloured irrorations; the markings pale chocolate-brown; an indistinct short line from the costa at the base; a band of conjoined somewhat square marks from the costal third to near the middle of the hinder margin, the band consisting of two somewhat sinuous lines crossed by six lines forming the squares; a somewhat similar but broader band divided by the cross-lines into four parts, its upper portion somewhat suffused, the band extending from the costa beyond the middle to near the hinder angle, its lower half with a short pale brown band attached to its outer side; a triangular pale brown patch on the outer margin a little above the middle; cilia pale orange with brown spots, except at its upper and lower parts, where it is concolorous with the wings with

\* Ann. & Mag. Nat. Hist. (9) ii. p. 72 (1915).

brown outer edges: hind wing and its cilia pure white. Head and body concolorous with the wings, abdomen with brown segmental bands; palpi orange, the terminal joints white. Underside: body and wings uniform silvery white.

Expanse of wings, ♀,  $1\frac{1}{8}$  inch.

Hab. Queensland.

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XXXII.—*The Status of Parabates, Foerster, and Parabatus, Thomson (Hymenoptera, Ichneumonidae)*. By J. CHESTER BRADLEY, Ph.D., Cornell University, Ithaca, N.Y.

THERE is a confusion concerning the status of the so-called genus *Parabates*. It was described by Foerster (1868) without mention of included species, being separated from *Paniscus* by reason of the front wing lacking an areolet. The only known Palearctic species in which this is normally the case is *nigricarpus* (in *millierata*, Kriechbaumer, it is in some individuals lacking). Specimens of *virgatus* without areola are not known to occur.

The International Commission on Zoological Nomenclature in its 16th published opinion has ruled on such cases that the genera are valid. "If (as in *Aclastus*, Foerster, 1868) it is not evident from the original publication of the genus, how many or what species are involved, the genus contains all of the species of the world which would come under the generic description as originally published, and the first species published in connection with the genus (as *Aclastus rufipes*, Ashmead, 1902) becomes *ipso facto* the type."

The species *rufipes* referred to as an example, having been described subsequent to the publication of *Aclastus*, Foerster, it is evident that the opinion means to include in the genus all species in the world which fit the original description, whether already described at that time or described subsequently.

The opinion states that the first species published in connection with the genus becomes *ipso facto* type, and we accordingly may infer that in the case of several species being simultaneously included in the first mention of species in the genus, without one of them being designated as type,



the ordinary rules of type-fixation must be applied. The opinion, however, leaves a little uncertainty, whether in such cases any of those species first included may be chosen as type, or whether it must be one that agrees with the original generic definition. In view, however, of the fact that the opinion says "the genus contains all of the species of the world which would come under the generic description as originally published," it would seem that the selection must be restricted to such of the first-published species as do come under the generic description as originally published, and that if none of them come under it they are none of them available. Mr. Viereck, in fixing the types of the genera of Ichneumonidea, has evidently thought otherwise.

Thomson (1888, Opusc. Ent. xii. 1194) established a genus *Parabatus*, without any reference to Foerster's name *Parabates*. In it he recognised two sections and four species as follows: Section A, without areolet [= *Parabates* in sense of Foerster's description], *nigricarpus*, sp. n.; Section B, *latungula*, sp. n., *virgatus*, Grav. (i.e. Fourcroy), and *cristatus*, sp. n.

The first mention of species, in connection with Foerster's original name *Parabates*, seems to have been in Dalle Torre's 'Catalogus Hymenopterorum,' iii. p. 75 (1903). The four species included by Thomson under *Parabatus* and four others are included under the generic name *Parabates*.

According to the code (Article 36, Recommendations-) *Parabatus*, Thomson, is potentially at least a distinct genus from *Parabates*, Foerster, whether they are synonyms depending entirely upon the fixation of the type of each and upon whether the types are congeneric. Viereck (1914) has fixed, correctly, the type of *Parabatus*, Thomson, as *virgatus* (*Ichneumon virgatus*, Fourcroy). Mr. Viereck (1914) also designates *virgatus*, Fourcroy, as the type of *Parabates*, Foerster, which would make *Parabates* and *Parabatus* identical, as is desirable. However, it does not seem that this is permissible. *Ichneumon virgatus*, Fourcroy, does not fall under the generic definition of Foerster's *Parabates* (in as much as it always possesses an areolet, as I have pointed out). It would, therefore, seem that it must be excluded from consideration as type of the genus. The only known Palearctic\* species that normally † agrees with Foerster's

\* *Ophelloideus johnsoni*, Ashmead, 1900, a Nearctic species, may be congeneric with *Parabatus nigricarpus*, Thomson, and like it lacks an

generic definition is *nigricarpus*, Thomson, which alone forms Section A of Thomson's *Parabatus*—a section, as I have already stated, distinguished by the absence of the areolet. It would therefore seem, and I hereby so designate it, that the type of *Parabates*, Foerster, must be *Parabatus nigricarpus*, Thomson, and that *Parabates*, Foerster, must be equivalent to Section A of Thomson's genus, and *Parabatus* to Section B.

Szepligeti (1911, 'Genera Insectorum,' fasc. 114) restricts *Parabates*, Foerster, to *nigricarpus*, Thomson, synonymizing Section A of *Parabates*, Thomson, with *Parabates*, Foerster, and Section B with *Paniscus*.

Schmiedeknecht (1910, 'Opuscula ichneumonologica,' iv. 1847), separates *Parabatus*, Thomson, from *Paniscus*, Gravenhorst, as follows:—

"Nervulus interstitial, sehr selten etwas vor der Gabel. Scheitel und Wagen hinten nicht durch eine Leiste abgegrenzt. Areola zuweilen fehlend.—*Parabatus*, Foerster.

"Nervulus weit hinter der Gabel. Hinterhaupt durch eine Leiste abgegrenzt. Areola stets vorhanden.—*Paniscus*, Grav."

He further remarks: "Es könnte wie bei so vielen Gattungen die Frage aufgeworfen werden, ob das nicht immer deutliche Vorhandensein oder Fehlen der Hinterhauptsleiste und die etwas Schwanken der Stellung des Nervulus genügt, um die beiden Gattungen *Parabatus* und *Paniscus* von einander zu trennen. Wem diese Unterscheidungsmerkmale nicht genügen, den mag die *Parabatus*-Arten mit zu *Paniscus* rechnen, aber er mag nicht behaupten, dass *Parabatus* und zahlreiche andere Gattungen nicht aufrecht erhalten werden können."<sup>1</sup>

Schmiedeknecht (*l. c.*, and earlier, 1904, 'Die Hymenopteren Mitteleuropas,' p. 605) states that *Parabates*, Foerster, has nothing to do with *Parabatus*, Thomson, and that what Foerster meant to include under *Parabates* is difficult to say. I do not believe that that is the case. *Parabatus nigricarpus*, Thomson, agrees entirely with Foerster's definition of *Parabates*, the only possible point of question being found in the following statement: "Cubitalquerader stark gebogen, mit

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areolet, but was not included by either Thomson or Dalle Torre in *Parabatus* or *Parabates*.

<sup>1</sup> As previously indicated, aberrant individuals of *millierata*, Kriechbaumer, also lack the areolet.

der Cubitalader nicht in einen Spitzen winkel zusammenstehend, letztere daher nicht aus der Spitze der Diskokubitalzelle hervorgehend." A comparison of the wing of *nigricarpus* with an *Eremotylus* (with which genus and *Allosamptus* Foerster is comparing *Parabates*) makes his meaning obvious.

Ashmead (1900, 'Classification of the Ichneumon Flies,' Proc. U.S. Nat. Mus. xxiii. 96) recognising minutiae of structure as of generic rank, erects a new genus *Opheltoideus* for the species without an areolet (and which would therefore include *nigricarpus* and be a synonym of *Parabates*, Foerster, as here defined) and separates *Parabates*, Foerster, which he states is equivalent to *Parabatus*, Thomson, from *Paniscus*, primarily on the basis that the basal and submedian veins are interstitial in the former, or very nearly, and the submedian cell longer than the median in the latter. In *Parabates* he further says the discocubital vein is not broken by a stump of a vein, while in *Paniscus* it is usually but not always so.

Morley (1913, 'Revision of the Ichneumonidae,' ii. 129) writes: "*Parabatus*, Thomson. Known from *Paniscus* only by the continuous basal nervulus through the median nervure, thus forming both the upper and lower basal nervures of a single line; this I do not always find associated with an occipital costa, and I have been obliged consequently to place species with this capital structure occasionally in the genus *Paniscus*. Thomson originally placed four Swedish species in the present genus and others were subsequently added; but Szepligeti, for some occult reason, has restricted Thomson's genus to a single species, the first here placed by its author, which differs from the other three in little more than the aborted areolet, and further he has synonymized—entirely arbitrarily, I think—Ashmead's Nearctic genus *Opheltoideus* with its single and still MS. species, *O. johnsoni*. I have already pointed out (Revis. Ichn. Brit. Mus. i. 60) that the latter almost certainly appertains to the *Anomalides*."

Szepligeti's course in restricting *Parabates* to the one species *nigricarpus* was not occult, but perfectly logical, since it is the only one falling under Foerster's original definition. Nor was it arbitrary to assign *Opheltoideus*, Ashmead, as a synonym, since the published characters of that genus leave no other course possible. On the other hand, Mr. Morley's conclusion that *Opheltoideus* is an anomalous genus is open to grave doubt. It was arrived at

solely on the basis of the determination by Herr Sigmund Brauns of a North American specimen sent him by Mr. Morley as "*Opheltoideus* sp.?" But there is not the slightest evidence that the determination was correct, or that Herr Brauns had any more knowledge of what *Opheltoideus* is than has Mr. Morley or anyone else who has not seen Ashmead's specimen of *johnsoni*.

Mr. Morley's key to the genera (1913, *l. c.* p. 101) makes no provision at all for *Parabates*, Foerster, s. s. (i. e. *nigricarpus*, Thomson, a species without an areolet), as it neither agrees with his *Paniscus* and *Parabatus*, both of which are stated to have an areolet, nor with *Parca* which is the only provision made for species with the areolet absent, but which differs in other respects.

Mr. Morley does not make it clear what species of *Paniscus* lack the occipital carinæ. It is weak in even the type-species, *testaceus*, and readily may not be associated with the relative length of the median and submedian cells, as he suggests, nor with any other structural character.

To sum up; there seem to be a group of species which have the nervulus interstitial ( $m-cu$  and  $M_4 + Cu_1$  opposite) and a group which do not, but of the former two or three species have the nervulus sometimes a little beyond the apex of the cell, and one species (*franki*, known from a single German female, which may be abnormal) has it widely before the apex of the median cell. On the other hand, specimens of *testaceus*, the type-species of *Paniscus*, determined for me by Professor Schmiedeknecht, show a varying distance between the apex of the median cell and the nervulus, in one case the distance being quite insignificant. Secondly, *nigricarpus*, *millieratæ*, *pallenscens*, *tarsatus*, *gansuanus*, *virgatus*, *latungula*, *cristatus*, and *franki* are stated by Schmiedeknecht (in giving his generic description) to lack an occipital carina, while he states that all of the species of *Paniscus* possess such a carina. So far as I have observed, this distinction holds, and probably is the best primary character available for group-definition. Morley, treating of additional species from other parts of the world, finds species lacking the carina which, on the basis of the venational character just discussed, he treats as *Paniscus*. Finally, *nigricarpus* and *johnsoni*\* lack an areolet normally, but at least also *millieratæ* in aberrant individuals.

\* In the case of *johnsoni* probably not enough individuals are known to be sure what is normal.

Since there seems, therefore, to be no strongly distinctive structural character between these groups, and especially since there seems to be *no association of structural characters*, their logical treatment would seem to be as at most subgenera of a single genus, *Paniscus*.

The arrangement and synonymy will therefore be:—

### PANISCUS, Gravenhorst.

#### Subgenus PANISCUS.

Type.—[*Ichneumon luteus*, Ross] = *Paniscus testaceus*, Gravenhorst, the only originally included species.

Distinguishing characters: Head with an occipital carina; nervulus ( $M_4 + Cu_1$ ) apicad of the apex of the median cell; areolet present and complete.

#### Subgenus PARABATUS, Thomson.

Type.—*Ichneumon virgatus*, Fourcroy, by designation of Viereck, 1914.

Distinguishing characters: Head without an occipital carina; nervulus interstitial, but in some species slightly apicad of the apex of the median cell, in another (known from a unique and possibly aberrant Palearctic female) basad thereof, and in some species not interstitial (according to Morley, who would on that account put them in *Paniscus*); areolet present in normal individuals, but lacking in aberrant individuals of at least one species.

#### Subgenus PARABATES, Foerster.

Type.—*Parabatus nigricarpus*, Thomson, by present designation, and by virtue of the fact that it is the only one of the species first included in *Parabates*, which comes under the original generic definition. Therefore, not *Ichneumon virgatus*, Fourcroy, which was cited as type by Viereck.

Synonym.—*Ophelloideus*, Ashmead, of which the type is *johnsoni*, Ashmead. Synonym by reason of the types being congeneric so far as published descriptions indicate.

Distinguishing characters: Head without an occipital carina; nervulus interstitial; areolet absent.

XXXIII.—*The Malacoderm Genera Prionocerus and Idgia, and their Sexual Characters [Coleoptera]*. By G. C. CHAMPION, F.Z.S.

[Plates XI. & XII.]

THIS paper is based upon a study of the species of *Prionocerus*, Perty, and *Idgia*, Cast., contained in the National Collection at S. Kensington, in the Hope collection at Oxford, and in that of Mr. H. E. Andrewes, the last-named being rich in Indian forms\*, including types or co-types of various insects determined by Bourgeois and Gorham. The British Museum material includes the types of three Indian species belonging to the genus *Idgia*—*Cantharis melanocephala*, Fabr., *Telephorus assimilis*, Hope, and *Thaccona dimelana*, Walk.—which have been omitted from or are wrongly placed in our catalogues; many interesting Malayan forms captured by Mr. Doherty or Mr. G. E. Bryant; and very extensive series of several species from the highlands of Eastern and Central Africa. The two genera here studied, which Lacordaire, Redtenbacher, and Bourgeois were inclined to treat as one, are restricted to Africa and Asia; and upwards of sixty species have been described as belonging to them, about half of these having been named during recent years by Pic.

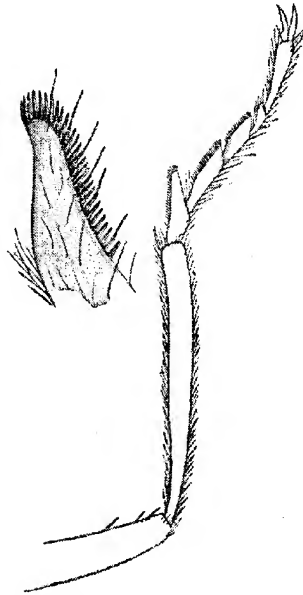
The sexual characters of the forms enumerated in this paper are described in detail, important tarsal and other structures having been apparently overlooked by all writers on these insects, including Bourgeois, who has given a good deal of attention to the subject. Another mark of distinction, unnoticed in our text-books, and common to the two sexes, is the single spur to the anterior tibiae, the absence of the second spur being characteristic of the Edemerid genera *Nacerdes* and *Xanthochroa*, the species of which bear a superficial resemblance to many *Idgia*. The males of *Prionocerus* and *Idgia* have, in common, a closely, regularly pectinate, black comb along the inner edge of joints 1-3 of the anterior tarsi, which is quite conspicuous in the yellow-legged forms†. A similarly pectinate comb

\* The types of the new species described from his collection and a selection of the others have been presented by Mr. Andrewes to the Museum.

† The males of one or two Lampyrids allied to *Phengodes* have a row of scattered teeth on the first joint.

on the front feet is also present in the corresponding sex of the Dasytid-genus *Lobonyx*, Jacq. Duval, in which, however, it is restricted to joints 2 and 3, the basal joint being relatively shorter than in the genera here studied; this structure, clearly visible in males of *Lobonyx* captured by myself in Spain and Algeria, has been figured and described by Duval (Gen. Coleopt. Europ. iii. p. 183, pl. 46. fig. 225 c).

Other ♂-characters, apart from the usually larger eyes, the stronger serration of the antennæ in *I. viridipennis* and



*Idgia plectrophora*, sp. n., anterior leg, ♂ (cf. p. 330).

*belli*, and the emargination of the fifth ventral segment, have been detected in certain cases, such as the thickening of the posterior femora, the curvature or sinuation of the posterior tibiæ, the acutely produced posterior trochanters, the form of the basal joint of the anterior and intermediate tarsi, &c.

In one species, *I. plectrophora*, all the tibial spurs are longer than usual in both ♂ and ♀; and in another the

upper posterior tibial spur is longer than the lower one. *I. flavirostris* and one or two others have the tarsal claws widened to near the middle, instead of at the extreme base only, but there is no trace of a membranous lobe in any of these insects. The numerous testaceous forms with the head in part or entirely, and the apices of the elytra, black have given me the greatest difficulty in distinguishing the species; and it has been found impossible in some cases to separate them at all satisfactorily till the ♂-genital armature, or the sixth ventral segment, has been examined. These structures have been dissected in nearly all the species of which the males are represented in the collections before me\*. The tegmen (*sensu* Sharp and Muir) is furnished with two elongate, digitiform or spoon-shaped lobes, convex and almost smooth above, concave beneath, together forming an open tube, the lower outer edge of each (lateral) lobe being more or less ciliate or finely denticulate, and sometimes sinuate or emarginate before the tip. The median lobe† (=penis-sheath or ædeagus of some authors) consists of a long, acuminate tube, usually curved downward at the tip, but peculiarly shaped in the two Arabian forms here described (*cf.* Pl. XI. figs. 9*a* and 10*a*), the opening from which the membranous sac or intromittent organ is extruded being placed on the dorsal aspect at some distance before the tip. The sixth ventral segment is normally triangularly emarginate in ♂, but in one species at least (*cf.* Pl. XII. fig. 49*a*) it is so deeply bi-excised as to appear trilobed.

One or two species have the sutural angle of the elytra strongly hooked or dentiform (*cf.* Pl. XII. fig. 50), a character peculiar to the ♀, as in the American genus *Astylius*. Figures of the ♂-armature of nearly all the species here enumerated are given on the accompanying Plates.

The "Prionocerides," forming a subtribe of the "Melyrids" of Lacordaire based upon *Prionocerus* and *Idgia*, should be treated as a separate group or family of the Malacodermata, distinguished by the emarginate eyes, the single spur to the anterior tibiae, the simple tarsi and claws (the latter at most widened in their basal half), the more or less curved or excavate eleventh antennal joint, and the closely pectinate tarsal joints 1-3 of the male.

\* They have all been made by Mr. A. Cant.

† *Cf.* Sharp and Muir, *Trans. Ent. Soc. Lond.* 1912 and 1918. The term "penis-sheath" has been used by me for this organ in a recently published paper on the genus *Astylius*.



## PRIONOCERUS.

*Prionocerus*, Perty, Obs. Coleopt. Ind. Orient. p. 33 (1831).

This genus, type *P. cæruleipennis*, Perty, a common Malayan insect, is here restricted to the species with the antennæ short and very strongly serrate, and the apical joint deeply excavate, in the two sexes. *P. bicolor*, Redt., belongs to it, and possibly one or two other Asiatic forms not represented in the collections before me. The two mentioned have a different general facies from the typical *Idgia*, due to their small, narrow head and short, strongly serrate antennæ.

1. *Prionocerus cæruleipennis*.

*Prionocerus cæruleipennis*, Perty, Obs. Coleopt. Ind. p. 33, t. 1. fig. 4 (1831); Bourg. Ann. Soc. Ent. Fr. 1890, p. 175; Gørh. Ann. Soc. Ent. Belg. xxxix. p. 318 (1895).

♀. *Prionocerus fuscipennis*, Lewis, Ann. & Mag. Nat. Hist. (5) iv. p. 464 (1879).

♂. *Prionocerus forticornis*, Schauf. Horæ Soc. Ent. Ross. xx. p. 126 (1887).

♀. *Prionocerus brevicornis*, Schauf. l. c.

♂. Anterior tarsal joints 1-3 with a comb along their inner edge. Genital armature (Pl. XI. fig. 1): lateral lobes very long, narrow and somewhat hooked at the tip; median lobe broad, abruptly acuminate and sinuate at apex.

*Hab.* INDIA; BURMA; MALAYAN REGION generally; ANDAMAN IS.; JAPAN; E. AFRICA, Usagara (*S. A. Neave*), Usambara (*Mus. Brit.*); AUSTRALIA (*sec. Schaufuss*).

Bourgeois gives the sexual characters of this species at considerable length, but he omitted to notice the structure of the ♂ anterior tarsi. The elytra vary in colour—blue, violaceous, or green, rarely æneo-fuscos. The two forms named by Schaufuss, already sunk as synonyms by Bourgeois, are from the Philippines and Macassar respectively. *P. fuscipennis*, Lewis, from Yokohama, is an immature ♀, with the elytra more obscurely coloured than usual, some specimens from Borneo and Manila in the British Museum being similar in that respect. A monstrosity, ♂, with three antennæ and distorted elytra, has been figured and described by Keyl (*Tijdschr. voor Ent.* lvi. pp. 1-12, pls. 1, 2, 1913). *P. cæruleipennis* has doubtless been introduced into E. Africa. About 200 examples are contained in the collections before me.

2. *Prionocerus bicolor*.

*Prionocerus bicolor*, Redt. Reise der Novara, ii. p. 109, t. 4. fig. 3 (1868); Gorh. Ann. Soc. Ent. Belg. xxxix. p. 318 (1895).

*Idgia* (*Prionocerus*) *bicolor*, var. *notaticollis*, Pic, L'Echange, xxvi. p. 53 (1910).

♂. Anterior tarsi and genital armature (Pl. XI. fig. 2) as in *P. cæruleipennis*, Perty, except that the median lobe is less sinuate at the tip.

Hab. INDIA, Sikkim, Allahabad; BURMA; SIAM; MALAYAN REGION generally.

This insect is extremely closely related to *P. cæruleipennis*, and occurs with it in some of the Malayan localities, differing from that species in having the antennæ a little less dilated in the two sexes, and the elytra wholly fulvous. The type was from Java. *P. bicolor* has been found in numbers by Mr. H. Stevens at Gopaldhara, in the Rungbong Valley, Sikkim, unaccompanied by its near ally. Females preponderate in the series before me. A variety from Tharrawaddy, Burma, with the scutellum yellow has been recorded by Gorham (*l. c.*), and another, from Sumatra, with a dark median patch on the prothorax, by Pic.

IDGIA.

*Idgia*, Castelnau, in Silbern. Rev. Ent. iv. p. 27 (1836); Hist. Nat. Ins. Coleopt. i. p. 275 (1840).

*Deromma*, Kollar and Redtenbacher, in Hügel's Kaschmir, iv. 2, p. 512 (1844).

*Diprosopus*, Mulsant, Mém. Acad. Lyon, i. p. 209 (1851).

*Thacœna*, Walker, Ann. & Mag. Nat. Hist. (3) iii. p. 260 (1859); Gemminger and Harold, Cat. Coleopt. vii. p. 2179 (1870) [sub (Edemeridæ)].

The generic name *Idgia*, type *I. terminata*, Cast., from Senegal, is here used for all the *Prionocerids* with the antennæ filiform or moderately serrate, at least in ♀. The structure of the anterior tarsi is precisely similar to that of *Prionocerus*, and the form of the genital armature of the males also shows their close relationship. The superficial resemblance of many of the species to the Edemerid *Nacerdes melanura*, L., and the Telephorid *Rhagonycha fulva*, Scop. (= *melanura*, Oliv.), is very striking, one, indeed, having been described as belonging to the first-named group. The Museum material includes, in addition to species here enumerated, a very elongate, large, subopaque, blue form,

coloured like the Chinese *I. hügelii*, Redt., represented by a single damaged example, which must be left unnamed for the present, no locality-label being attached to it.

#### African Species.

Prothorax (except in *I. dimidiata*, var. *tripartita*, Pic) and elytra testaceous, the apical portion of the latter to a greater or less extent black.

Tibial spurs long.....	No. 1.
Tibial spurs short .....	Nos. 2-6.
Prothorax and elytra nigro-cyaneous .....	No. 7.
Prothorax fulvous, the elytra black or nigro-cyaneous ....	No. 8.

#### 1. *Idgia plectrophora*, sp. n.

Extremely like *I. (Prionocerus) dimidiata*, Gerst., and similarly coloured, and only separable therefrom by its structural characters: tibial spurs long, including the one on the anterior pair, in both sexes, strongly developed in ♂; anterior tarsal joints 1 and 2 elongated, 1 slightly curved, smooth and almost glabrous at the base, and produced into a dentiform lobe at the inner apical angle, 4 small, narrow, the comb on 1-3 extending along the greater part of their length; joint 1 of intermediate and posterior tarsi compressed, slightly curved, and smoother at the base. Genital armature (Pl. XI. fig. 3): lateral lobes long, broad, rounded at tip; median lobe narrow, drawn out into a long, slender, downwardly-curved point.

Length (excl. head) 9-13, breadth  $3\frac{1}{2}$ - $4\frac{1}{2}$  mm. (♂ ♀.)

*Hab.* E. AFRICA, Tabora (*ex coll. Fry*: type, ♂), Salt Lake—Wawamba (*Scott Elliot*), East shore of Victoria Nyanza near Karungu, Lusinga Isl., Kisumu (Port Florence), Upper Kuja valley, S. Kavirondo (*S. A. Neave*), S. Masai Reserve (*T. J. Anderson*), Mogorr River (*A. O. Luckman*); UGANDA, W. and S.E. Ankole (4400-5000 ft.), and S. of Lake George (*S. A. Neave*), Maramu and Kamwezi (*C. H. Marshall*).

The series examined includes upwards of 250 examples, showing but little variation, the black apical patch rarely reaching forward to the middle of the elytra, the prothorax constantly fulvous, the armature of the tibiae and tarsi perfectly constant, the females separable from the same sex of *I. dimidiata* by the longer tibial spurs. The genital armature of several males has been examined.

2. *Idgia dimidiata*.

*Prionocerus dimidiatus*, Gerst. Arch. für Naturg. xxxvii. p. 56 (1871)<sup>1</sup>;  
Von der Decken's Reise in Ost-Afrika, iii. 2, p. 158, t. 8. fig. 11  
(1873)<sup>2</sup>.

Elongate, depressed, slightly widened posteriorly; thickly pubescent, the elytra also with scattered, long, seriatly arranged, erect black setae, the head and prothorax with numerous curled black bristly hairs, those behind the eyes projecting laterally; black, the prothorax and scutellum, and the elytra with from one-fourth to nearly one-half their length, fulvous or luteous, the apical patch often with a bluish or violaceous lustre. Head polished, with a few small scattered punctures, the labrum large, transverse, angularly dilated laterally; eyes very large in ♂, a little smaller in ♀, well separated in both sexes; antennae moderately long in ♂, shorter in ♀, joints 3-11 longer than broad, widened, subserrate, 7-10 decreasing in length, 11 much longer than 10, concave on its inner face. Prothorax as long as broad, sparsely punctured. Elytra long, densely granulato-punctate, the seriatly arranged setigerous impressions each preceded by a minute tubercle, the apices obtuse, in some specimens angulate at the sutural angle.

♂. Anterior tarsal joints 1-3 with a comb along their inner edge, 1 simple, scarcely longer than 2, 4 small, shorter and narrower than 3; joint 1 of intermediate and posterior tarsi simple, slightly longer than 2; posterior tibiae feebly curved. Genital armature (Pl. XI. fig. 4): lateral lobes long, broad, rounded or obtuse at tip; median lobe gradually narrowed, drawn out into a very long, slender, curved, somewhat sinuate point at apex.

Length (excl. head)  $9\frac{1}{2}$ - $13\frac{1}{2}$ , breadth  $3\frac{1}{2}$ -5 mm. (♂ ♀.)

Hab. ABYSSINIA, Higo Samula (*R. J. Sturdy*); E. AFRICA, Mombasa<sup>1</sup> [type], Masongaleni (alt. 3000 ft.), Kibwezi (alt. 3000 ft.), M'gori Valley in S. Kavirondo (alt. 4200 ft.), Mitito Andei (alt. 2500 ft.), Makindu (alt. 3300 ft.), Voi (alt. 1800 ft.), Usangu district (alt. 3500-4500 ft.) (*S. A. Neave*), Lulanguru (*G. D. H. Carpenter*), Samburu (*C. S. Belton*); NYASALAND, Masai (*Mus. Brit.*), Mombera district (alt. 4000 ft.), Lilongwe district in Central Angoniland (alt. 4000-5000 ft.) (*S. A. Neave*); N.E. RHODESIA, on road Fort Jameson-Lundazi (alt. 4000 ft.), Upper Luangwa River (*S. A. Neave*); MASHONALAND, Salisbury (*G. A. K. Marshall*); ZULULAND (*Mus. Brit.*); NATAL (*Mus. Brit.*), Greytown (*H. B. Marley*), Estcourt (*G. A. K. Marshall*), Port Natal (*Boheman*<sup>2</sup>); ? S. AFRICA, Cape of Good Hope (*Mus. Brit.*).

Var.  $\alpha$ . The scutellum more or less infusate and the apical half of the elytra black. ( $\delta$  &  $\eta$ .)

Hab. E. AFRICA, W. slopes of Kenya on Meru-Nyeri road (alt. 6000-8500 ft.) (S. A. Neave); NYASALAND, Valley of Rukuru, Karonga district (alt. 2000-4000 ft.) (S. A. Neave).

Var.  $\beta$ . The prothorax and scutellum black, the prothorax sometimes rufo-variegate or fulvous with an indeterminate black patch on each side of the disc. ( $\delta$  &  $\eta$ .)

*Idgia tripartita*, Pic, Bull. Soc. Ent. Fr. 1912, p. 300<sup>3</sup>.

Hab. E. AFRICA<sup>3</sup> (C. S. Betton), 30 miles from Magadi Junction (F. G. Hamilton), Kibwezi (alt. 3000 ft.), Nairobi to Fort Hall Road (alt. 4500-5000 ft.) (S. A. Neave); N. NIGERIA, Panyam in Banchi Province (G. F. Fox).

About 200 examples of this species are contained in the Museum collection, including specimens from the two localities quoted by Gerstaecker, Mombasa and Natal. The variety *tripartita* was received with the typical form from Kibwezi, five of the thirty examples before me being intermediate, having the prothorax partly red. The long series from the slopes of Kenya (6000-8500 ft.), and those from the Karonga district of Nyasaland are also darker than typical *dimidiata*, having the apical half of the elytra and the scutellum black, these specimens (39  $\eta$  &  $\eta$ , 5  $\delta$  &  $\delta$ ) forming a transition to the still darker *tripartita*. Some of the southern examples ( $\delta$  &  $\eta$ ) have the elytra distinctly angulate at the sutural angle, a character apparently of no great importance. Males of each form have been dissected, showing a similar genital armature. The tuft of long hairs behind the eyes mentioned by Pic in his description of *I. tripartita* is to be found in all the allied African species known to me. His *I. nigricollis* (1906), from Sierra Leone, is not represented in the collections at the Museum.

### 3. *Idgia terminata*.

*Idgia terminata*, Cast. Hist. Nat. Ins. Coleopt, i. p. 275 (1840).

$\delta$ . Elongate, rather narrow, shining, thickly pubescent, and also set with scattered, curled or erect, blackish bristly hairs, those on the elytra seriately arranged; testaceous, the head (the labrum excepted), joints 5-11 of the antennae, a large patch at the apex of the elytra, the knees, tibiae, and tarsi black. Head as wide as the prothorax; eyes

extremely large, almost contiguous; labrum transverse, subtrapezoidal, moderately large; apical joint of maxillary palpi long, cultriform; antennæ moderately long, joints 4-10 gradually increasing in width and decreasing in length, 10 longer than broad, 11 about the length of 9 and 10 united, curved, hollowed on its inner face. Prothorax longer than broad, very uneven, rugulosely punctate. Elytra long, rounded at the tip; densely, rugulosely punctate. Anterior tarsal joints 1-3 with a narrow black comb on their inner edge. Genital armature (Pl. XI. fig. 5): lateral lobes broad, short; median lobe drawn out into a very long, slender, strongly curved point.

Length (excl. head) 9, breadth 3 mm.

*Hab.* W. AFRICA, Senegal (*Mus. Brit.*).

A male in the Museum, labelled "*Epiphyta melanura*, Dj., Senegal," agrees with the brief diagnosis of *I. terminata*, Cast., from that locality, and a longer description is given from the specimen before me. It is separable from *I. longipalpis* by the smaller labrum, the shorter, less dilated antennæ, and the wholly testaceous prothorax. *I. abyssinica* has a much larger labrum, a smaller head, a narrower apical patch, &c. The similarly-coloured *Prionocerus senegalensis*, Cast., under which *E. melanura*, Dej., is placed as a synonym in the 'Munich Catalogue,' should have the antennæ serrate as in the type-species of that genus.

#### 4. *Idgia apicalis*.

*Prionocerus (Idgia) apicalis*, Gerst. Arch. für Naturg. xxxvii. p. 56 (1871); Von der Decken's Reise in Ost-Afrika, iii. 2, p. 159 (1873).

♂. Eyes very large, subapproximate above and beneath; anterior tarsal joints 1-3 with a black comb along their inner edge, 4 small, narrow. Genital armature: lateral lobes long, broad; median lobe narrow, acuminate, somewhat hooked at the tip.

*Hab.* E. AFRICA, Mombasa and Zanzibar.

A male from Zanzibar, received by the Museum in 1868, is certainly referable to this species. A narrow, elongate, ochraceous insect, with the head (except in front), and a small patch at the tip of the elytra, black; the antennæ long, subfiliform; the body thickly pubescent, the head with numerous long dark bristly hairs, and the elytra sparsely, seriately nigro-setose; the apical joint of the maxillary palpi long, subcultriform; the labrum transverse, subquadrate. The genital armature has not been dissected, but it is partly extruded in the single specimen before me.

5. *Idgia abyssinica*, sp. n.

♀. Elongate, rather narrow, shining, thickly pubescent, and also set with scattered, curled or erect, long black bristly hairs, those on the disc of the elytra seriatly arranged, the margins of the latter nigro-ciliate; fulvo-testaceous, the head (the labrum excepted), joints 5-11 of the antennæ, the elytra and abdomen at the tip, and the legs (the bases of the femora excepted), black. Head rather small, somewhat produced in front; labrum broad, transverse, large, angularly dilated; apical joint of maxillary palpi subcultriform; eyes large, well separated; antennæ long, rather slender, joints 5-10 slightly widened, subserrate, 7-10 decreasing in length, 11 much longer than 10, hollowed within. Prothorax as long as broad, wider than the head, uneven, sparsely, rugulosely punctate. Elytra very long, rounded at the tip; densely, rugulosely punctate, the seriatly-arranged setæ each preceded by a minute smooth granule. Legs rather stout, long.

Length (excl. head) 10, breadth 3 mm.

*Hab.* ABYSSINIA (*Mus. Brit.*).

One female, acquired in 1876. Not unlike *I. apicalis*, but broader, with a larger labrum, and stouter, outwardly infusate antennæ, the legs (the bases of the femora excepted) and apex of the terminal ventral segment black. The general system of coloration is like that of *I. assimilis*, Hope, and many other eastern members of the genus, most of which have a much smaller labrum. The elytra are broader and less parallel, the antennæ are stouter, the head is smaller, and the apical joint of the maxillary palpi is less elongate, than in *I. longipalpis*. The antennæ are not so slender as in the Indian *I. assimilis*, Hope, from which the unusually enlarged, angularly dilated labrum is sufficient to distinguish the present species.

6. *Idgia longipalpis*, sp. n.

♂. Elongate, narrow, shining, thickly pubescent, the head and prothorax also set with long, curled, projecting or erect, black bristly hairs, the elytra seriato-nigro-setose on the disc and strongly ciliate along their outer margin; black or piceous, the palpi and labrum, the basal four or more joints of the antennæ, the anterior femora at the base, the anterior tibiæ, the tarsi in part, and the elytra for fully two-thirds of their length, testaceous, the prothorax rufescent or testaceous along the basal, apical, and outer margins.

Antennæ long, rather slender, subfiliform. Eyes extremely large, almost contiguous. Labrum large, angularly dilated, transverse. Apical joint of maxillary palpi elongate, cultriform, that of the labial palpi securiform. Prothorax narrower than the head, very uneven, rugulose punctate. Elytra elongate, rounded at the tip; densely, rugulose punctate, the seriatly-arranged setæ each preceded by a minute smooth tubercle. Sixth ventral segment sulcate down the middle. Anterior tarsal joints 1-3 with a narrow black comb along their inner edge, 4 small. Genital armature (Pl. XI. fig. 6): lateral lobes long, broad; median lobe abruptly narrowed towards apex, the apical portion long and slender, sharply hooked at the tip beneath.

Length (excl. head)  $8\frac{1}{2}$ -9, breadth  $3-3\frac{1}{2}$  mm.

*Hab.* ABYSSINIA (*Mus. Brit.*).

Three males, received in 1876. Closely related to *I. apicalis*, Gerst., and separable therefrom by the large black apical patch on the elytra, the broadly infusate disc of the prothorax, the blackish under surface and legs, the more elongate apical joint of the maxillary palpi, and the different genital armature.

#### 7. *Idgia cyanea*.

*Idgia cyanea*, Pic, L'Echange, xxii. p. 43 (1906).

♂. Tarsi formed very much as in *I. dimidiata*, joints 1-3 of anterior pair with a similar comb on their inner edge, 1 and 2 subequal in length, 4 small, shorter than in ♀; tibial spurs small, as in ♀. Genital armature (Pl. XI. fig. 7): lateral lobes narrower than in *I. dimidiata*; median lobe sinuate, and drawn out into a long, narrow point, which is abruptly curved downward and rather blunt at tip.

*Hab.* UGANDA, S.E. shore of Lake Kioga and between that place and Kakindu in W. Busoga, alt. 3400-3500 ft. (*S. A. Neave*); S. NIGERIA, Oyo Yoruba.

Thirteen examples from Uganda, including five males, are referred to this species, the type of which was from Oyo Yoruba. Very like *I. dimidiata*, var. *tripartita*, wholly black or bluish black, with the exception of the rufous tarsal claws and the uniformly nigro-cyaneous elytra, the antennæ a little less widened.

#### 8. *Idgia fulvicollis*.

*Idgia fulvicollis*, Reiche in Ferret and Gallinier's Voy. Abyssin., Ins. p. 286, t. 17. figs. 5, 6 *a-c* (1849). (♂ ♀.)

♂. Eyes larger, more convex, and more narrowly separated



than in ♀; anterior tarsal joints 1-3 with a conspicuous comb along their inner edge, 4 small; posterior tibiae curved. Genital armature (Pl. XI. fig. 8): lateral lobes rather short; median lobe drawn out into a long, slender, curved point.

*Hab.* ABYSSINIA (*Mus. Brit.*); E. AFRICA, Alhi Plains and Nyems Ndogo (*Gregory*), Higo Samula (*R. J. Sturdy*: 30. x. 1911).

There are five males and three females of this species in the Museum, including a ♀ from Abyssinia received in 1855. A hairy, elongate insect, black or piceous, with the prothorax and tarsal claws, and usually the scutellum also, testaceous, the elytra with a faint bluish tinge; the antennal joints 3-10 elongated and slightly widened, 11 curved, hollowed on its inner face, much longer than 10 in ♂. The faintly indicated elytral costae are exaggerated in Reiche's figure. *I. fulvicollis* has the antennae less widened than in *I. dimidiata*, both species occurring at the same locality in Abyssinia. *I. henonii*, Fairm., from Choa (1883), may be a form of the ♀ with an infusate prothorax? The genital armature is very like that of *I. dimidiata* and *I. plectrophora*.

#### *Arabian Species.*

- |   |         |
|---|---------|
| Prothorax and elytra testaceous, the apical portion of latter broadly black; antennae long and slender in ♂ and ♀; head rostrate .....  | No. 9.  |
| Prothorax testaceous, elytra nigro-cyaneous; antennae long and broadly dilated in ♂, shorter and less widened in ♀; head rostrate ..... | No. 10. |

#### 9. *Idgia arabica*, sp. n.

? *Prionocerus hirtus*, Walk, List Coleopt. J. K. Lord, p. 14 (1871).

Very elongate, somewhat widened posteriorly, shining, the elytra rather dull; finely pubescent and sparsely nigro-setose; fulvous, the head (the labrum and epistoma excepted) and the antennae from about the fourth joint black, the elytra with a large apical patch (occupying one-third or more of their length) nigro-cyaneous. Head long, narrow, strongly produced anteriorly, the labrum about as long as broad, hollowed down the middle; eyes very large, moderately convex, subcontiguous in ♂, narrowly separated in ♀; antennae long in ♂, a little shorter in ♀, joints 5-10 elongate, feebly serrate, moderately widened, subequal in length, 11 concave within, slightly longer than 10. Prothorax oblong-subquadrate, wider than the head, uneven,

quite sparsely punctulate. Elytra very elongate, at the middle twice as wide as the prothorax, densely granulato-punctate. Legs very long.

♂. Posterior femora feebly clavate; anterior tarsal joints 1-3 with a narrow black comb along their inner edge; terminal dorsal segment entire. Genital armature (Pl. XI. figs. 9, 9a): lateral lobes sinuate, curved inward and somewhat hooked at the tip, as seen from above (fig. 9a), broad as seen in profile (fig. 9); median lobe gradually acuminate, the apex broadly, abruptly dilated, subsagittiform.

Length (excl. head) 11-14, breadth  $3\frac{1}{2}$ - $4\frac{2}{3}$  mm. (♂ ♀.)

Hab. ARABIA, Yemen (*Millingen, in Mus. Brit.*).

The above description is taken from four males and three females. They agree with Walker's diagnosis of *P. hirtus*, except as regards their larger size, the unnotched eyes\*, and the broad joints to the antennæ. His type, from Tajura, on the opposite African coast, appears to have been lost. The median lobe of the male is very peculiarly formed.

#### 10. *Idgia laticornis*, sp. n.

Elongate, somewhat widened posteriorly, shining, the elytra duller; finely pubescent and sparsely nigro-setose; fulvous, the head (the labrum and epistoma excepted) and the antennal joints 5-11 black, the elytra nigro-cyaneous or black. Head long, narrow, strongly produced anteriorly, the labrum about as long as broad, hollowed down the middle; eyes very large, moderately convex, narrowly separated in ♂, more distant in ♀; antennæ (♂) elongate, joints 4-11 broad, stout, feebly serrate, tapering towards the apex, 4 not longer than 3, 5-10 subequal in length, longer than broad, 11 deeply excavate within, longer than 10, (♀) much shorter and more slender. Prothorax wider than the head, oblong-subquadrate, narrowed anteriorly, uneven, sparsely punctulate. Elytra very long, at the middle twice as wide as the prothorax, densely granulato-punctate.

♂. Anterior tarsal joints 1-3 with a black comb along their inner edge; anterior tibiæ slightly curved towards the apex; posterior trochanters toothed behind. Genital armature (Pl. XI. figs. 10, 10a): lateral lobes rather short, narrowed and slightly sinuate distally, as seen from above; median lobe stout, abruptly bent downward and broadly, angularly dilated towards apex, the apical portion straight, hooked above and beneath at tip.

\* Almost certainly an error of observation.

Length (excl. head)  $10\frac{1}{2}$ – $12\frac{1}{2}$ , breadth  $3\frac{1}{4}$ –4 mm. ( $\sigma$  ♀.)

Hab. ARABIA, Yemen (*Millingen*), Ktubu and El Kubar (*G. W. Bury*).

Three males and two females. Near *I. arabica*, but with the  $\sigma$ -antennæ dilated as in a Lycid, the elytra wholly nigro-cyanaceous or black. One of the females, that from El Kubar, somewhat discoloured, has the head almost entirely black, the legs partly infusate, and the elytra black. The narrow, elongate head, broad antennæ, shorter pubescence, differently coloured body, &c., separate *I. laticornis* from the Abyssinian *I. fulvicollis*, Reiche. The stout, abruptly bent median lobe, as seen from above, has the long apical portion broadly sagittiform.

#### Chinese Species.

Prothorax and elytra testaceous, the apices of the latter black. ....	Nos. 11, 12.
Prothorax flavous, head and elytra metallic; tarsal claws simple; body narrow, elongate. ....	No. 13.
Prothorax and front of head testaceous, elytra obscurely metallic; tarsal claws widened basally; body narrow, very elongate. ....	No. 14.
Prothorax, base of head, and elytra uniformly greenish; tarsal claws widened basally; body very narrow and elongate. ....	No. 15.

#### 11. *Idgia deusta*.

*Idgia deusta*, Fairm. Ann. Soc. Ent. Fr. (5) viii. p. 118 (1878).

$\sigma$ . Anterior tarsal joints 1–3 with a comb along their inner edge; posterior tibiae (as in ♀) almost straight and with very small spurs. Genital armature (Pl. XI. fig. 11): lateral lobes long, broad, curved inward at the tip, as seen from above; median lobe long, rather narrow, feebly sinuate from near the base, terminating in a slender hooked point.

Hab. CHINA (*Fortune*, in *Mus. Brit.*), Foo-Chow (*C. B. Ricket*, *G. Lewis*), Suiling in W. China (*W. A. Maw*), Shanghai (*J. J. Walker*).

Numerous specimens from the above-mentioned localities are referred to *I. deusta*, Fairm., the type of which was found by Abbé David in Central China. Bourgeois (Ann. Soc. Ent. Belg. xxxvi. p. 238, 1892) sinks the Chinese insect as synonymous with the Indian *I. melanura*, Koll. & Redt., which also has the tip of the elytra and the whole of the head black, the legs and antennæ infusate, the eyes very large, &c.; the present species, however, has the upper surface less densely punctate and more shining (approaching

*I. nitida* in that respect), and the ♂-armature very different from that of *I. melanura*.

The length (excl. head) varies from  $8\frac{1}{2}$ –10 mm. The eleventh antennal joint is deeply excavate and more than twice the length of the tenth.

12. *Idgia unguolata*, sp. n.

Elongate, narrow, shining, finely pubescent, and sparsely setose; testaceous, the head (except the labrum in part or wholly, and sometimes a spot at the base), and a small patch at the apex of the elytra, black, the antennæ, tibiæ, tarsi, and apices of the femora more or less infusate. Head somewhat produced in front, the labrum transverse, concave eyes very large, almost contiguous in ♂; antennæ slender, distinctly widened outwards, joint 4 a little shorter than 3 or 5, 11 deeply excavate within, twice as long as 10: Prothorax very little wider than the head, slightly longer than broad, feebly sinuate at the sides posteriorly, sparsely punctuate. Elytra moderately elongate, finely, somewhat densely punctate.

♂. Anterior tarsal joints 1–3 with a comb along their inner edge; posterior tibiæ distinctly arcuate towards the apex, the spurs strongly developed, curved, the upper one longer than the other. Genital armature (Pl. XI. fig. 12): lateral lobes long, broad; median lobe sinuate, gradually narrowed to the rather blunt tip.

Length (excl. head)  $6-7\frac{1}{2}$ , breadth  $2-2\frac{3}{4}$  mm.

*Hab.* CHINA (*Mus. Brit.*), Hong Kong (*Mus. Brit.*, *F. W. Terry*, *J. J. Walker*), Amoy (*G. Lewis*).

A long series, males preponderating. Less elongate than *I. deusta* as here identified, the head not wholly black in front, the apical patch smaller; the male with differently formed posterior tibiæ, longer asymmetric spurs (suggestive of those of certain *Scirtes*), and dissimilar genital armature.

13. *Idgia flavicollis*.

*Idgia flavicollis*, Redt. Reise der Novara, ii. p. 111 (1868); Fairm. Ann. Soc. Ent. Fr. (6) ix. p. 45 (1889).

♂. Eyes distant, as in ♀; anterior tarsal joints 1–3 with a comb along their inner edge. Genital armature (Pl. XI. fig. 13): lateral lobes long; median lobe narrow, pointed at tip.

*Hab.* CHINA, Hong Kong.

There is a long series of this species in the Museum, including several examples captured by Commander Walker

in 1893. A slender insect, not unlike an *Asclera* (fam. Edemeridæ), green or bluish green, with the palpi, antennæ, and sometimes the tibiæ and apex of the abdomen also, testaceous or flavous; the antennæ very slender; the head small. Two males have been dissected. *I. flavicollis* appears to have been unknown to Pic.

#### 14. *Idgia flavirostris*.

*Idgia flavirostris*, Pasc. Journ. Ent. i. p. 43 (April 1880); Fairm. Ann. Soc. Ent. Fr. (6) ix. p. 44 (1889).

♂. Eyes small, distant, as in ♀; anterior tarsal joints 1-3 with a comb along their inner edge. Genital armature (Pl. XI. fig. 14): lateral lobes long, narrowed outwards, their apices truncate and hooked beneath; median lobe gradually narrowed, curved upward at the tip.

*Hab.* CHINA (*Mus. Brit.*), Chusan Is. (*J. J. Walker*), Ta-maon Isl., Hong Kong (*Mus. Brit.*).

Of the eighteen examples of this species before me, including the type, one only, from the Chusan Is., is of the male sex. A close ally of *I. flavicollis*, with a longer prothorax and very elongate elytra, the anterior portion of the head, palpi, basal joints of the antennæ, prothorax, and femora testaceous. The head is small and comparatively short. The tarsal claws are distinctly widened to about the middle. An allied form from China has been described by Fairmaire under the name *I. moupinensis*.

#### 15. *Idgia virescens*, sp. n.

♀. Very elongate, narrow, subopaque, finely cinereo-pubescent, and sparsely nigro-ctose; obscure metallic green, the anterior half of the head, palpi, antennæ, underside of prothorax, abdomen, coxæ, femora, and tibiæ in part, testaceous. Head scabroso-punctate, small, slightly produced in front, excavate between the eyes, the labrum transverse; eyes distant; apical joint of maxillary palpi elongate; antennæ very slender, long, joints 3 and 4 equal in length, those following still more elongate. Prothorax longer than broad, wider than the head, somewhat dilated at the middle, opaque, densely, very finely scabroso-punctate. Elytra very elongate, much broader than the prothorax, rounded at the tip; densely, rugulosely punctate, each with five series of conspicuous granules on the disc, the margins crenulate. Legs very long and slender; tarsal claws widened to about the middle.

Length (excl. head) 8½, breadth 2 mm.

*Hab.* W. CHINA, Chin-Fu-San (*M. A. Maw*).

One specimen, in poor condition, received by the Museum in 1908. Near *I. flavirostris*, Pasc., but smaller, narrower, and more slender, the prothorax opaque and coloured, like the elytra, the seriatly arranged granules on the latter conspicuous.

*Indian and Malayan Species* \*.

- a. Antennal joints [♀] 8-10 serrate, different in shape from those preceding; head small; prothorax vittate; elytra broad, black ..... No. 16.
  - b. Antennal joints 8-10 similar in shape to those preceding.
    - a<sup>1</sup>. Antennal joint 4 very short, about as long as 2, the antennæ themselves strongly serrate in ♂; prothorax testaceous; elytra metallic ..... No. 17.
    - b<sup>1</sup>. Antennal joint 4 nearly or quite as long as 3 or 5.
      - a<sup>2</sup>. Antennæ strongly serrate in ♂; body brilliantly metallic ..... No. 18.
      - b<sup>2</sup>. Antennæ not strongly serrate in ♂, not differing greatly in the two sexes.
        - a<sup>3</sup>. Elytra metallic; the prothorax rufescent or testaceous, maculate in some of the species.
          - a<sup>4</sup>. Posterior femora not thickened in ♂ ..... Nos. 19-21.
          - b<sup>4</sup>. Posterior femora more or less thickened in ♂. .... Nos. 22-24.
        - b<sup>3</sup>. Elytra infusate or black (paler in *I. gorhami*, Pic, var.), sometimes with a metallic lustre; the prothorax testaceous, maculate in *I. nil-girica* ..... Nos. 25-30.
      - c<sup>3</sup>. Elytra infusate, with the sutural and outer margins in part or entirely flavescent; the prothorax testaceous, maculate in *I. marginata*. .... Nos. 31, 32.
      - d<sup>3</sup>. Elytra viridi-vittate on disc and the prothorax maculate, the former dilated at base ..... No. 33.
    - e<sup>3</sup>. Elytra and prothorax testaceous or luteous, the former black at tip.
      - c<sup>4</sup>. Posterior femora thickened in ♂ ..... Nos. 34-36.
      - d<sup>4</sup>. Posterior femora not thickened in ♂.
        - a<sup>5</sup>. Apical patch on elytra extending forward to about the middle ..... Nos. 37, 38.
        - b<sup>5</sup>. Apical patch moderately large, rarely reaching so far forward ..... Nos. 39-48.
        - c<sup>5</sup>. Apical patch small.
          - a<sup>6</sup>. Sixth ventral segment triangularly emarginate in ♂ ..... Nos. 49-59.
          - b<sup>6</sup>. Sixth ventral segment trilobed in ♂. .... No. 60.
- Species provisionally referred to *Idgia* (♂ wanting):
- small, slender, metallic, Dasytiform ..... No. 61.

16. *Idgia triserrata*, sp. n.

♀. Moderately elongate, widened posteriorly, the head and prothorax shining, the elytra dull, finely pubescent and

\* ♂ ♂ wanting of Nos. 16, 33, 37, 43, 48, 59.

sparsely setose; bluish black, the head nigro-aneous, the basal joints of the antennæ obscurely rufescent, the prothorax (an elongate black patch on the disc excepted) rufo-testaceous. Head small, narrow, somewhat produced anteriorly, the labrum concave, nearly as long as broad, rounded at the sides; eyes distant; antennæ short, slender at the base, widened outwards, joints 8-10 serrate, 10 subtransverse, 11 concave within, barely as long as 9 and 10 united. Prothorax much wider than the head, about as long as broad, uneven, polished on the disc, sparsely punctate laterally. Elytra broad, long, widened to beyond the middle, rounded at the tip; densely, finely, rugulose punctate. Legs rather short.

Length (excl. head) 10, breadth 4 mm.

*Hab.* INDIA, Manipur (*Doherty*).

One specimen. This species resembles *Prionocerus cæruleipennis* and *P. bicolor* in shape, but it has the antennæ slender at the base and joints 8-10 abruptly serrate; the head is small and narrow; the prothorax is red, with a black, anteriorly narrowed median vitta; and the elytra are broad, dull, and bluish black in colour. *I. submetallica*, Pic (1911), from Kandy, which has the elytra red, except at the tip, seems to be an allied form.

#### 17. *Idgia viridipennis*.

♀. *Idgia viridipennis*, Pic, L'Echange, xxii. p. 55 (1906).

*Prionocerus viridipennis*, Bourg. Ann. Soc. Ent. Belg. li. pp. 103, 104 (1907). (♂ ♀.)

*Hab.* S. INDIA, Wallardi in Travancore [type], Anamalai Hills, alt. 1100 metres (*H. L. Andrewes*).

This species is easily recognizable by the very short fourth joint to the antennæ, the bluish-green head, elytra, under surface, and legs, the testaceous prothorax, and the partly testaceous basal joints of the antennæ. The three females from the Anamalai Hills in the Andrewes collection have joints 5-10 of the antennæ cyaneous, considerably widened, and distinctly serrate, these joints, according to Bourgeois, being broadly serrato-dilatate in the ♂; his definition of the ♀ antenna as "subfiliform" is misleading. The sutural angle of the elytra in ♀ is dentiform, as described by Pic.

#### 18. *Idgia belli*.

*a belli*, Gorb. Ann. Soc. Ent. Belg. xxxix. p. 319 (1895)¹.

*Prionocerus cæruleatus*, Fairm. Notes Leyden Mus. xviii. p. 94

♂. Eyes much larger, more convex, and more approximate, and the antennal joints 6-10 broader and more strongly serrate, than in ♀; anterior tarsal joints 1-3 with a comb along their inner edge, 4 small, narrow; terminal dorsal segment rounded at tip. Genital armature (Pl. XI. fig. 15): lateral lobes long, rounded at apex; median lobe narrow, sharply acuminate, curved at tip.

*Hab.* S. INDIA (*Mus. Brit.*), Kanara<sup>1</sup> (*T. R. Bell*), Malabar<sup>2</sup> (*type of Fairmaire*), Nilgiri Hills (*H. L. Andrewes*, *A. K. Weld Downing*, *Sir G. F. Hampson*), Travancore (*G. S. Inray*), Periya Ghat [Malabar], alt. 2500 ft. (*E. Bullard*).

An elongate, slender, brilliantly metallic green, blue, or æneous insect, with the ♂-antennæ dilated and strongly serrate, approaching that of the type of *Prionocerus*; the legs long and slender; the labrum trapezoidal, rather large, deeply foveate in the centre at the base; the apical joint of the maxillary palpi elongate-triangular; the terminal joint of the antennæ curved and deeply excavate. Mr. Andrewes's collection contains a long series of this species from the Nilgiri Hills, and there are numerous examples of it in the British Museum. The Kanara type of Gorham is ♀.

#### 19. *Idgia viridescens*.

*Idgia viridescens*, Gorh. Ann. Soc. Ent. Belg. xxxix. p. 319 (1895).

*Prionocerus metallescens*, Fairm. Notes Leyden Mus. xviii. p. 94 (1896).

♂. Eyes larger and more approximate, and the antennal joints 5-10 a little more acute at their inner apical angle, than in ♀; anterior tarsal joints 1-3 with a comb along their inner edge, 4 small, narrow; terminal dorsal segment bisinuato-truncate at apex. Genital armature (Pl. XI. fig. 16): lateral lobes broad, narrower and curved inward at tip, as seen from above; median lobe stout, acuminate, and almost straight at apex.

*Hab.* N. INDIA (*Mus. Brit.*), Simla (*Hauser: type of Fairmaire*), Kasauli (*Col. H. J. W. Barrow; coll. Andrewes*), W. Almora (*H. G. Champion*), Gopaldhara, Rungbon Valley, Sikkim (*H. Stevens*), Mungphu, Sikkim (*ex coll. Atkinson*); CENTRAL INDIA (*Capt. Boys, in Mus. Oxon.*).

A large, elongate, rather broad, posteriorly widened, obscure æneous or nigro-cæruleous form, with the prothorax and the tip of the antennæ fulvous or testaceous; the labrum transversely subquadrate, small, concave; the eleventh antennal joint curved and deeply excavate; the apical joint of the maxillary palpi elongate. Numerous



specimens of this insect have recently been sent by my son from W. Almora, from elevations between 7000 and 9000 ft. Two males have been dissected. Gorham's description of *I. viridescens* was based upon two examples ( $\delta$ ?) from "India." The yellow base of the last abdominal segment mentioned by him doubtless refers to the pallid membranous space visible between the ventral segments 5 and 6 in  $\delta$ .

#### 20. *Idgia andrewesi*.

*Prionocerus (Idgia) andrewesi*, Bourg. Ann. Soc. Ent. Belg. li. p. 104 (1907). ( $\delta$  ♀.)

$\delta$ . Eyes extremely large, almost contiguous (narrowly separated in ♀); anterior tarsal joints 1-3 with a comb along their inner edge, 4 narrow, small; posterior trochanters acuminate at tip (obtuse in ♀). Genital armature (Pl. XI. fig. 17): median lobe rather broad, as seen from above, narrower than the lateral lobes, sinuate, acuminate at tip, the latter subtruncate; lateral lobes moderately broad, the concave apical portion, as seen from beneath, separated from the rest by an oblique fold.

*Hab.* S. INDIA (*Mus. Brit.*), Nilgiri Hills (*H. L. Andrewes, Sir G. F. Hampson*), Anamalai Hills (*H. L. Andrewes*).

An elongate, nigro-cyanaceous insect, with a long, flavo-testaceous prothorax, the basal joints of the antennæ, and also the apical one, the palpi, and sometimes the scutellum in part, flavescens; the antennæ long and slender, with joint 11 sinuate, considerably elongated in  $\delta$ ; the apical joint of the maxillary palpi long; the head somewhat produced in front; the labrum narrow, somewhat oval, about as long as broad in some specimens, shorter in others. There are two males and six females of this species in Mr. Andrewes's collection, and a pair in the British Museum. Bourgeois overlooked the tarsal and trochanter characters, which are conspicuous in the labelled type,  $\delta$ . The length varies from 11-13 mm.

#### 21. *Idgia chloroptera*.

*Idgia chloroptera*, Redt., Reise der Novara, ii. p. 111 (1868).

$\delta$ . Eyes large, subcontiguous (a little more distant in ♀); anterior tarsal joints 1-3 with a comb along their inner edge. Genital armature (Pl. XI. fig. 18): lateral lobes long, broad; median lobe curved and acuminate at tip.

*Hab.* CEYLON [type] (*Thwaites, in Mus. Oxon.*:  $\delta$ ), Kapulahani (*Mus. Brit.*:  $\delta$ ), Maskeliya (*E. E. Green*: ♀).

There is a pair of this species in the British Museum and a male in the Hope collection at Oxford. A very elongate, dull, greyish-green insect, with the anterior and basal margins of the prothorax, the extreme bases of the femora, the abdomen, and the under surface in great part, testaceous; the antennæ slender, filiform; the prothorax rugulose, the dark patch on the disc sometimes divided down the middle; the elytra unusually long and densely, rugulosely punctate; the legs slender in both sexes.

22. *Idgia cyanocephala*, sp. n.

Elongate, narrow, subparallel, moderately shining, finely cinereo-pubescent, and sparsely nigro-setose; cyaneous, the elytra and under surface greenish, the prothorax and basal joints of the palpi testaceous, the antennæ piceous, testaceous at the base and tip. Head narrow, moderately produced anteriorly, the labrum transverse; eyes somewhat distant in both sexes; antennæ slender, subfiliform, joints 3 and 4 about equal in length, 11 much longer than 10, concave within. Prothorax scarcely wider than the head, sinuate at the sides posteriorly, about as long as broad. Elytra elongate, subparallel, at the middle twice as wide as the prothorax, rounded at the tip, flattened on the disc; densely, rugulosely punctate, with four rows of rather prominent granules, the margins crenulate. Legs slender.

♂. Anterior tarsal joints 1-3 with a narrow comb along their inner edge; posterior femora slightly thickened. Genital armature (Pl. XI. fig. 19): lateral lobes moderately long, feebly sinuate, narrowed towards apex; median lobe stout, sinuate, pointed.

Length (excl. head)  $7\frac{1}{2}$ - $8\frac{1}{2}$ , breadth  $2\frac{1}{4}$  mm. (♂ ♀.)

Hab. MALACCA, Perak (*Doherty*).

One male and two females. Smaller than the Indian *I. viridipennis*, Pic, the head narrower, the antennæ slender and with the fourth joint as long as the third, the eyes larger, the elytra flattened on the disc, the fourth row of granules forming a distinct ridge. Compared with *I. ceruleiventris*, which also occurs at Perak, the metallic-blue head, elytra, and legs and the slightly thickened posterior femora of the ♂ will serve to distinguish *I. cyanocephala*.

23. *Idgia rouyeri*.

*Idgia rouyeri*, Pic, L'Echange, xxii. p. 43 (1906).

Elongate, narrow (♂), broader (♀), shining, thickly

pubescent, and sparsely nigro-setose; testaceous, the head, the outer halves of the femora, the antennæ (except at the base and tip), and sometimes the tibiæ and tarsi also, infusate or black, the elytra bluish, bluish green, or fusco-æneous, the prothorax in two examples with a small blackish spot on each side. Head rather small, the labrum transverse; eyes very large and subcontiguous in ♂, somewhat narrowly separated in ♀; antennæ slender, slightly thickened towards the apex, moderately long, joint 11 deeply excavate within, a little longer than 10. Prothorax longer than broad, sinuate at the sides posteriorly, uneven, sparsely punctulate. Elytra long, subparallel; densely, rugulosely punctate, and with seriatly arranged grauaules extending down the disc, the margins crenulate.

♂. Intermediate and posterior tibiæ feebly curved; posterior femora thickened; anterior tarsal joints 1-3 with a comb along their inner edge, 4 small. Genital armature (Pl. XI. fig. 20): lateral lobes long; median lobe stout, sinuate, acuminate at tip.

Length (excl. head) 9-10, breadth  $2\frac{1}{2}$ - $3\frac{1}{2}$  mm. (♂ ♀).

*Hab.* JAVA [*Rouyer*: type] (*Mus. Brit.*, *Mus. Oxon.*), Depok (*G. E. Bryant*: 18. iv. 1909); SUMATRA, Palembang.

Four males and four females, two of the latter with a bimaculate prothorax, are referred to this species, the colour-characters only of which are briefly given by Pic in a synoptic table.

#### 24. *Idgia femorata*, sp. n.

Elongate, rather broad, robust, shining, finely pubescent, and sparsely setose; testaceous, the head (the labrum excepted) black, the elytra nigro-cæruleous. Head somewhat produced in front, the labrum transverse, subquadrate; eyes extremely large and narrowly separated in ♂, more distant in ♀; antennæ long, shorter in ♀, joints 5-10 moderately widened, 3-7 elongate, 8-10 gradually decreasing in length, 11 much longer than 10, concave within. Prothorax about as long as broad, somewhat rounded at the sides. Elytra long, finely, densely, rugulosely punctate. Terminal dorsal segment entire.

♂. Anterior tarsal joints 1-3 with a comb along their inner edge; posterior femora incrassate. Genital armature (Pl. XI. fig. 21): lateral lobes long; median lobe stout, drawn out into a curved point.

*Var.?* The antennæ (except at base) and legs (the basal

portions of the femora excepted) infusate or black, the elytra less metallic.

Length (excl. head)  $10\frac{1}{2}$ –12, breadth 3–4 mm. ( $\delta$  ♀.)

*Hab.* INDIA (*Walter Elliot*, in *Mus. Brit.*: type,  $\delta$ ), Belgaum (*H. E. Andrewes*: type ♀), Mysore (*Mus. Oxon.*: var.,  $\delta$ ), Poona (*coll. Andrewes*: var., ♀).

Described from a similarly coloured pair, the  $\delta$  without definite locality. The examples with partly infusate legs and antennæ, the  $\delta$  with thickened posterior femora, seem to belong to the same species, the genital armature being similar in the two forms. *I. femorata* is closely related to *I. gorhami*, Pic, as here restricted, differing from it in the strongly incrassate posterior femora in  $\delta$ , the simple terminal dorsal segment in both sexes, and the slightly dilated antennæ. The median and lateral lobes are much shorter than in the two males of *I. gorhami* dissected. The type,  $\delta$ , of the present species was presented to the British Museum many years ago.

#### 25. *Idgia gorhami*.

*Idgia gorhami* and var. *diversipennis*, Pic, Bull. Soc. Ent. Fr. 1911, p. 241 (excl. var. with bimaculate prothorax)<sup>1</sup>.

$\delta$ . Anterior tarsi, terminal dorsal segment, and genital armature (Pl. XI. fig. 22) as in *I. dimelæna*, Walk. (= *cardoni*, Bourg.), No. 44, infra.

*Hab.* INDIA (*Mus. Brit.*), Nilgiri Hills<sup>1</sup> (*Sir G. F. Hampson*, *H. L. Andrewes*, *A. K. Weld Downing*), Coonor (*W. Davison*), Belgaum<sup>1</sup> (*H. E. Andrewes*), Kanara (*T. R. Bell*); BURMA, Paungde (*Mus. Brit.*).

The dissection of two males from the Nilgiri Hills shows that *I. gorhami* is a form of *I. dimelæna*, Walk., with infusate, submetallic elytra, the variety *diversipennis* being intermediate. The two insects are common in the Nilgiri Hills, but as *I. gorhami* does not appear to extend to Ceylon it is here given specific rank. The anterior portion of the head, the antennæ, scutellum, legs, and under surface are testaceous, as in *I. dimelæna*, and the terminal dorsal abdominal segment is similarly cleft at the tip in the two sexes, the apex appearing bilobed.

#### 26. *Idgia nilgirica*, sp. n.

*Idgia oculata*, Gorch. Ann. Soc. Ent. Belg. xxxix. p. 319 (1895) (nec Redt.).

*Idgia gorhami*, Pic, Bull. Soc. Ent. Fr. 1911, p. 241 (var. with bimaculate prothorax).

Elongate, narrow ( $\delta$ ), broader ( $\varphi$ ), subparallel, feebly shining, finely pubescent, and sparsely nigro-setose; testaceous, the head (the labrum excepted), and a large oblong patch on each side of the prothorax, black, the antennæ (except at the base and tip), elytra and legs (except the bases of the femora to a variable extent) fuscous or nigro-fuscous, the elytra sometimes with a faint bluish tinge. Head rather long, narrow, the labrum transverse, trapezoidal, concave; antennæ slender, filiform, joint 11 concave, a little longer than 10. Prothorax slightly longer than broad, sinuate at the sides posteriorly, densely, rugosely punctated. Elytra elongate, densely, rugulose punctured, and with rows of scattered granules on the disc.

$\delta$ . Anterior tarsal joints 1-3 with a narrow comb along their inner edge; terminal dorsal segment deeply, narrowly cleft in the middle at apex (the notch much deeper than in  $\varphi$ ). Genital armature (Pl. XI. fig. 23): lateral lobes curved, broad; median lobe drawn out into a long, slender, compressed piece, which (as seen from above) is feebly dilated and somewhat spoon-shaped at the tip\*.

Length (excl. head) 8-11, breadth 2-3 mm. ( $\delta$  &  $\varphi$ .)

Hab. INDIA, Nilgiri Hills (*H. L. Andrewes, Sir G. F. Hampson, A. K. Weld Downing*).

Two males and eight females. Narrower than *I. gorhami*, the prothorax rougher and nigro-bimaculate, the legs and antennæ partly infusate. The  $\delta$  has a similarly cleft (or bilobed) terminal dorsal segment, but the genital armature is very different. The allied *I. flavolimbata* and *I. marginala*, from the same region, have the sutural and outer margins of the elytra more or less testaceous, and the terminal dorsal segment simple. *I. maculicollis*, Pic (1906), from Java, has a similarly maculate prothorax.

## 27. *Idgia cæruleiventris*, sp. n.

Elongate, narrow, subparallel, shining, closely cinereo-pubescent, and sparsely nigro-setose; nigro-fuscous, the head black, under surface and femora bluish or violaceous, the palpi, basal joints of the antennæ, prothorax, and tarsal claws testaceous. Head slightly elongated anteriorly, the labrum transverse; eyes large, narrowly separated in  $\delta$ , more distant in  $\varphi$ ; antennæ long, slender, a little shorter in  $\varphi$ , joint 11 concave within, considerably longer than 10. Prothorax about as long as broad, very little wider than the

\* Not visible in profile figure.

head, sinuate at the sides posteriorly. Elytra long, densely, finely, rugulose punctate with rows of conspicuous raised granules on the disc, the apices rounded. Legs slender in both sexes. Terminal ventral segment conical.

♂. Anterior tarsal joints 1-3 with a narrow comb along their inner edge. Genital armature (Pl. XI. fig. 24): lateral lobes abruptly narrowed and curved downward towards the apex, the slender apical portion hooked at the tip above; median lobe stout, sinuate distally, simply acuminate at apex.

Length (excl. head) 6-8, breadth 2-2½ mm. (♂ ♀.)

*Hab.* MALACCA, Penang (*Mus. Brit.*, *H. N. Ridley*), Perak (*Doherty*).

Thirteen specimens, including males from each locality, the two from Penang [types] dissected exhibiting peculiarly modified lateral lobes in ♂. This is one of four extremely closely allied small Malayan or Indian forms, with a testaceous prothorax and the rest of the body and legs infusate.

#### 28. *Idgia cavilabris*, sp. n.

♂. Extremely like *I. cæruleiventris* and similarly coloured above, but differing as follows: the head broader, the labrum concave, the eyes somewhat distant (as in ♀ *cæruleiventris*), large, and convex; the prothorax longer and narrower, not so wide as the head; the elytra with the serially arranged granules inconspicuous; the ventral segments not metallic. Genital armature (Pl. XII. fig. 25): lateral lobes elongate, stout; median lobe drawn out into a very long slender point, which is sharply sagittate at tip.

Length (excl. head) 7, breadth 2 mm.

*Hab.* S. INDIA, Nilgiri Hills, alt. 3000 ft. (*H. L. Andrewes*), Kanara (*T. R. D. Bell*).

Two males—one with the scutellum testaceous, from the Nilgiri Hills, taken as the type, the other (injured by pinning) dissected and exhibiting a very peculiarly formed median lobe.

#### 29. *Idgia uncigera*, sp. n.

Extremely like *I. cæruleiventris*, but differing as follows: black or pitchy black (the under surface included), the antennæ (except several of the intermediate joints in ♀), palpi, and prothorax testaceous; the eyes larger, subcontiguous in ♂; the antennæ considerably widened from joint 6 onward in ♂, shorter and more slender in ♀; the

elytra in ♀ furnished with a long, slender, curved hook, or a shorter dentiform process, at the sutural angle (Pl. XII. fig. 50).

Length (excl. head) 7-8, breadth  $2\frac{2}{3}$ - $2\frac{1}{2}$  mm.

*Hab.* BORNEO, Kuching in Sarawak (*J. E. A. Lewis*: ♂ ♀), Quop in W. Sarawak (*G. S. Bryant*: iii., iv. 1914: ♀), Kina Balu (*Mus. Brit.*: ♀), Sanga Sanga, Moorjawa (*H. D. Jensen*: ♀).

Two males and five females. The ♀ found by Mr. Jensen in E. Borneo has a shorter and straighter tooth at the sutural angle than in the other specimens of that sex before me, *I. viridipennis*, Pic, ♀, having the elytra somewhat similarly armed. The Kuching males were not detected at the Museum till after the Plates accompanying this paper had been drawn, and the genital armature therefore has not been dissected for figuring; the apices of the elytra of ♀, however, are shown on the second Plate (Pl. XII. fig. 50).

### 30. *Idgia javana*, sp. n.

♂. Very like *I. cœruleiventris* and *I. uncigera*; nigro-fuscous, the palpi [antennæ broken] and prothorax testaceous, the legs reddish brown, the head grooved between the eyes, the latter narrowly separated, the elytra less elongate, the terminal ventral segment convex, conical, narrow, polished. Genital armature (Pl. XII. fig. 26): lateral lobes broad, spoon-shaped at tip as seen from beneath, narrowed distally as seen in profile; median lobe drawn out into a long, rather narrow, upwardly curved point.

Length (excl. head)  $6\frac{3}{4}$ , breadth 2 mm.

*Hab.* JAVA (*Mus. Brit.*).

One male, with genital armature so different from that of *I. cœruleiventris* that a name is required for the Javan insect, which may be referable to *I. sumatrensis* or its var. *I. kannegieteri*\*, Pic, from Sumatra, Java, and Borneo. The only tangible characters given for *I. sumatrensis* are the small size (length 9 mm.) and the very narrow, infusate, non-metallic elytra, the type having a maculate prothorax. It is highly probable that more than one species was included by the author under the latter name.

### 31. *Idgia marginata*, sp. n.

Elongate, narrow, and subparallel (♂), broader (♀), moderately shining, finely cinereo-pubescent, and sparsely nigro-

\* 'L'Echange,' xxii. p. 43 (1906); op. cit. xxvi. p. 75 (1910).

setose; testaceous, the head (the labrum and anterior margin of epistoma excepted) black; the elytra nigro-fuscos or fusco-violaceous, with the sutural and outer margins very narrowly testaceous at the base or to near the apex, the apices sometimes with an indeterminate black patch; the antennæ in one specimen fusco-annulate. Head slightly produced anteriorly, the labrum transverse; eyes very large and subcontiguous in ♂, narrowly separated in ♀; antennæ slender, joint 11 a little longer than 10. Prothorax about as wide as the head in ♂, longer than broad, wider in ♀, strongly sinuate at the sides posteriorly, closely, rugulose punctate. Elytra very long, quite narrow in ♂; densely, rugulose punctate, with rows of somewhat conspicuous granules on the disc. Terminal dorsal segment of the abdomen simple.

*Var.* The elytra testaceous with an indeterminate black patch at the shoulders and apex. (♀.)

♂. Anterior tarsal joints 1-3 with a black comb along their inner edge. Genital armature (Pl. XII. fig. 27): lateral lobes short, broad, slightly curved, as seen from above; median lobe curved, compressed from about the middle, and drawn out into a blunt, downwardly directed point.

Length (excl. head) 8-11, breadth 2-3½ mm. (♂ ♀.)

*Hab.* INDIA, Nilgiri Hills (*H. L. Andrewes*).

Two males and ten females, including two of the variety which corresponds with the var. *diversipennis* of *I. gorhami*, Pic. More shining than *I. flavolimbata* from the Anamalai Hills, the antennæ, legs, and under surface testaceous, the ♂-armature very different. The males are much narrower than specimens of the same sex of *I. gorhami*, and are separable therefrom by the simple terminal dorsal segment of the abdomen, the pale sutural and outer margins of the elytra, and the ♂-armature.

### 32. *Idgia flavolimbata*, sp. n.

♂. Elongate, narrow, subparallel, depressed, shining, the elytra dull; finely pubescent and sparsely setose; fuscos, the head (the labrum included) black, the palpi, base and tip of the antennæ, prothorax (a broad space on the disc excepted), scutellum, mesosternum, coxæ, and bases of femora, testaceous; the elytra with a sharply defined black patch at the apex, the sutural and outer margins to near the tip, the extreme base, and an indeterminate undulate fascia preceding the apical spot, testaceous. Head moderately long, the labrum transverse, concave; eyes very large, subcontiguous;



antennæ long, slender, joint 11 about as long as 10, concave. Prothorax slightly longer than broad, not wider than the head, sinuate at the sides posteriorly, rugulose. Elytra very long, narrow, subparallel, densely, rugulosely punctate. Anterior tarsal joints 1-3 with a narrow comb along their inner edge. Terminal dorsal segment rounded at apex. Genital armature (Pl. XII. fig. 28): lateral lobes long, narrow, almost straight, angularly dilated on their lower edge basally, as seen in profile; median lobe stout, feebly curved, gradually acuminate to the tip.

♀. Antennæ darker at base; eyes less approximate; prothorax with two large, oblong, black patches on the disc, densely rugulose; scutellum infusate; elytra uniformly nigro-fuscous (the pallid sutural and outer margins excepted) to the tip.

Length (excl. head)  $8\frac{1}{2}$ -9 $\frac{1}{2}$ , breadth  $2\frac{1}{2}$ -3 mm.

Hub. S. INDIA, Anamalai Hills (H. L. Andrewes).

One male [type] and two females, assumed to be the sexes of the same species. A close ally of *I. nilgirica* with the sutural and outer margins of the elytra testaceous to near the tip, the genital armature very different. The ♂ has the apices of the elytra peculiarly marked, the black apical spot being bordered in front by a pallid undulate line. *I. circumdata*, Pic (1909), from "Indes ou Java," and *I. suturalis*, Kirsch (1875), from Malacca, must be allied forms, the latter having the prothorax wholly testaceous.

### 33. *Idgia viridivittata*, sp. n.

♀. Very elongate, narrow, depressed, subopaque (the head excepted) above, shining beneath, finely cinereo-pubescent, the head with several long bristly hairs; the epistoma; palpi, antennæ, margins, apex, and base of prothorax, sutural region (broadly) and outer margin (narrowly) of elytra, and bases of femora, testaceous, the labrum black, the head between and behind the eyes, a broad space across the disc of the prothorax, and the legs in great part, nigro-cæruleous, the scutellum, a broad vitta extending down the outer part of the disc of the elytra to near the apex, and the under surface (the testaceous ventral sutures excepted) green or bluish green. Head small, produced in front, the epistoma transverse, convex, extending forwards, limited behind by a deep groove; labrum transverse, subtrapezoidal; antennæ long, slender, filiform; eyes large, rather widely separated. Prothorax as long as broad, wider than the head, narrowed anteriorly, transversely depressed towards the base,

scabroso-punctate. Elytra extremely elongate, depressed along the suture, twice as wide as the prothorax at the base, gradually narrowed from the somewhat swollen humeri to the tip, the apices produced, dehiscent, and rather sharp; densely, very finely, rugulosely punctate, the seriatly-arranged setigerous impressions clearly traceable. Legs long and slender.

Length (excl. head) 13-13½, breadth 3¼-3½ mm.

Hab. ASSAM, Nagas (*Doherty*).

Described from two females, both abraded and in rather decayed condition. The extremely elongate, subacuminate, basally widened, viridi-vittate elytra, narrow head and prothorax, filiform, testaceous antennæ, &c., readily distinguish this species, which has the general facies of a large *Edemerid*. It may have to be removed from *Idgia* when the male is found.

### 34. *Idgia maculiventris*, sp. n.

Elongate, robust, the prothorax and elytra opaque, the rest of the surface shining, finely pubescent and sparsely nigro-setose; luteous, the head (the sides of the labrum excepted), a rather large patch at the tip of the elytra, and the apex of the abdomen, black or bluish black. Head small, the labrum transverse, trapezoidal, concave; eyes very large and almost contiguous in ♂, narrowly separated in ♀; antennæ slender, comparatively short, filiform, joint 11 a little longer than 10. Prothorax slightly wider than the head, about as long as broad, rugulose. Elytra very long, twice as broad as the prothorax, subparallel, narrow at the tip; densely, rugulosely punctate, the erect seriatly-arranged setæ very conspicuous.

♂. Posterior femora incrassate; posterior tibiæ curved, compressed and slightly widened at the apex; anterior tarsal joints 1-3 with a black comb along their inner edge; terminal dorsal segment rounded at tip. Genital armature (Pl. XII. fig. 29): lateral lobes rather narrow, long, widened in their basal two-thirds beneath, the distal edge of the dilated portion flavo-ciliate; median lobe very long, sinuate, drawn out into a somewhat hooked, upwardly curved, blunt point.

Length (excl. head) 10½-11, breadth 3-3½ mm. (♂ ♀.)

Hab. S. INDIA, Nilgiri Hills (*H. L. Andrewes*).

One male and three females. Separable from large examples of *I. dimelana* by the relatively broader elytra and the black tip to the abdomen, the male with incrassate posterior femora and curved posterior tibiæ, the genital armature also different.

35. *Idgia flavilabris*, sp. n.

Elongate, narrow, slightly widened posteriorly in ♀, shining, finely pubescent, and sparsely setose; luteous, the head (the labrum excepted) and a rather small apical spot on the elytra black. Head small, the labrum transverse, flattened; eyes extremely large, contiguous in ♂, very narrowly separated in ♀; antennæ long, slender, filiform, joint 11 concave within, twice as long as 10. Prothorax longer than broad, about as wide as the head, sinuate at the sides posteriorly. Elytra elongate, at the middle twice as wide as the prothorax; densely, finely punctate, the setæ on the disc and margins long and conspicuous.

♂. Sixth ventral segment triangularly emarginate; posterior femora moderately incrassate; posterior tibiæ hollowed at the apex within, the spurs short; anterior tarsal joints 1-3 with a black comb along their inner edge; terminal dorsal segment rounded at tip. Genital armature (Pl. XII. fig. 30; lateral lobes narrow, curved downward and more slender at the apex; median lobe drawn out into a blunt curved point at the tip.

Length (excl. head) 8½-9, breadth 2½-3 mm. (♂ ♀.)

Hab. MALACCA, Perak (*Doherty*: ♂ ♀), Penang (*G. E. Bryant*: 30. x. 1913: ♀).

One male and three females. Near *I. maculiventris*, which also has the posterior femora incrassate in ♂; but smaller, narrower, and more shining, the apical spot on the elytra not so large, the ventral segments wholly luteous, the ♂ with peculiarly formed posterior tibiæ and dissimilar genital armature. *I. bourgeoisii*, Pic (1906), from Java, length 12-13 mm., is probably another allied form; it is described as having slightly dilated posterior femora in ♂, the elytra narrow and very elongate, the posterior part only of the head black, &c.

36. *Idgia geniculata*, sp. n.

♂. Elongate, narrow, subparallel, shining, finely pubescent, and sparsely setose; testaceous, the head (the epistoma and labrum excepted), a streak at the apices of the femora, and a rounded spot at the apex of the elytra, black. Head rather small, the labrum transverse, flattened; eyes large, somewhat narrowly separated; antennæ long, slender, filiform, joint 11 concave and longer than 10. Prothorax longer than broad, very little wider than the head, sinuate at the sides posteriorly. Elytra long, at the middle nearly twice as wide as the head;

densely, finely punctate, with rows of small scattered granules on the disc. Posterior femora moderately incrassate; posterior tibiae simply arcuate, of equal width to the apex; anterior tarsal joints 1-3 with a black comb along their inner edge; terminal dorsal segment broadly subtruncate at tip. Genital armature (Pl. XII. fig. 31): lateral lobes moderately long, curved inwards at the tip as seen from above; median lobe drawn out into an almost straight, blunt point.

Length (excl. head) 8, breadth  $2\frac{1}{4}$  mm.

*Hab.* CEYLON, Hapulahani, Haldummulle (*Mus. Brit.*).

Described from a single male, the only other specimens before me from the same locality, ♀ ♀, being certainly referable to the closely allied *I. dimelæna*, Walk., the ♂ of which has slender posterior femora, almost straight posterior tibiae, and a different genital armature.

37. *Idgia dichroa*, sp. n.

♀. Elongate, shining, finely pubescent, and sparsely setose; luteous, the head (labrum included) black, the apical half of the elytra nigro-cæruleous. Head slightly produced in front, narrow, the labrum transverse, unimpressed; eyes very large, subcontiguous; antennæ long, slender, filiform, joint 11 elongate, feebly sinuate within, about  $2\frac{1}{2}$  times the length of 10. Prothorax a little wider than the head, oblong-subquadrate, slightly sinuate at the sides posteriorly; sparsely, very finely punctate. Elytra long, about twice as wide as the prothorax, densely, finely punctate, the seriatly-arranged granules on the disc somewhat conspicuous on the apical half.

Length (excl. head) 10, breadth  $3\frac{1}{4}$  mm.

*Hab.* BORNEO, Sarawak (*A. R. Wallace, in Mus. Oxon.*).

One female, in good condition. This species agrees with the description of *I. longissima*, Pic, from Sumatra, in having an unusually elongate eleventh antennal joint, differing from it in the entirely pale limbs, and in the shorter, relatively broader elytra, with much more extended bluish-black apical patch. *I. semitecta*, from Ceylon, is somewhat similarly coloured.

38. *Idgia semitecta*, sp. n.

♂. Elongate, narrow, moderately shining, finely pubescent (the setæ abraded); testaceous, the head (the labrum excepted) and nearly the apical half of the elytra black, the antennal joints 5-11 nigro-piceous. Head rather long, the

labrum transverse, flattened; eyes very large, narrowly separated; antennæ unusually elongate, slender, widening outwards, joint 11 nearly twice as long as 10, concave. Prothorax slightly wider than the head, longer than broad, sinuate at the sides posteriorly, rugulose punctate. Elytra very long, a little widened posteriorly; densely, rugulose punctate, with an indication of raised lines on the disc. Anterior tarsal joints 1-3 with a black comb along their inner edge. Terminal dorsal segment broadly subtruncate at tip. Genital armature (Pl. XII. fig. 32): lateral lobes moderately long; median lobe sinuate, drawn out into a downwardly-curved point at the tip.

Length (excl. head) 8, breadth  $2\frac{1}{2}$  mm.

*Hab. CEYLON (Mus. Brit.).*

One male, received at the Museum in 1875. A very narrow, elongate insect, with the antennæ unusually lengthened and infusate from near the base to the tip, the black apical patch on the elytra occupying nearly the apical half. A somewhat similar form was found by Wallace at Sarawak. *I. semitecta* might easily be mistaken for a Telephorid of the genus *Rhagonycha*. It is allied to *I. dimelena* and other somewhat similarly coloured species with simple posterior femora in ♂. *Prionocerus (Deromma) redtenbacheri*, Kirsch (1875), from Malacca, which is said to have a broader apical black patch than *I. melanura*, seems to be an allied form.

### 39. *Idgia melanocephala*.

*Cantharis melanocephala*, Fabr. Sp. Ins. i, p. 280 (1781).

*Idgia ceylonica*, Pic, L'Echange, xxvi. p. 76 (1910).

“*C. testacea*, capite elytrorum apicibus tibiisque nigris. Habitat in Coromandel. Mus. Dom. Banks, Magna. Caput cum antennis atrum immaculatum. Thorax marginatus, testaceus, immaculatus. Elytra lævia, testacea, apice nigra. Abdomen testaceum. Pedes nigri femoribus testaceis.” [Fabricius.]

♂. Anterior tarsal joints 1-3 with a narrow comb along their inner edge. Genital armature (Pl. XII. fig. 33): lateral lobes moderately long, broad, feebly sinuate; median lobe with the apical portion very long, narrow, compressed, abruptly curved downward at the tip, and armed with a sharp tooth before the apex above.

*Hab. S. INDIA*, Coromandel (*coll. Banks*), Bangalore (*Mus. Brit.*); *CEYLON* (*F. B. Fletcher*), Hapulahani (*Mus. Brit.*), Wadduwa (*Pic*).

There are five specimens of this species in the Museum, in addition to the Fabrician type. It is not unlike the E. African *I. dimidiata*, Gerst., but more sparsely pilose, the head, palpi, antennæ, legs (the bases of the femora excepted), and nearly the apical third of the elytra, black, the rest of the body fulvous; the antennæ, ♂ ♀, moderately long, feebly serrate, the eleventh joint curved, concave within, as long as 9 and 10 united; the labrum large, trapezoidal; the eyes large, somewhat narrowly separated in the two sexes. The genital armature figured is taken from the Hapulahani ♂.

40. *Idgia assimilis*.

*Telephorus assimilis*, Hope, Zool. Misc. 1831, p. 26.  
*Diprosopus melanurus*, Muls. Mém. Acad. Lyon, i. p. 210 (1851).  
*Idgia melanura*, Bourg. Ann. Soc. Ent. Belg. xxxvi. p. 237 (1892);  
 Gorb. op. cit. xxxix. p. 319 (1895) (nec Kollar and Redt.).

"Intens, antennis flavis elytrorumque apicibus nigris. *T. melanuro*, Fabr., proximus. Long. lin. 5, lat. 1½." [Hope.]

Elongate, narrow, moderately shining, finely pubescent, and sparsely nigro-setose; testaceous, the head (the labrum and anterior portion of the epistoma excepted), a patch at the apex of the elytra, the outer halves of the femora, and usually the tibiæ and tarsi in great part, piceous or black, the antennæ (joint 11 excepted) more or less infuscate towards the apex. Head moderately large, not much produced in front, the labrum transverse, trapezoidal, concave; antennæ in ♂ long and slender, shorter in ♀; eyes large and almost contiguous in ♂, well separated in ♀; apical joint of maxillary palpi elongate. Prothorax slightly longer than broad, narrow, sinuate at the sides posteriorly. Elytra long, subparallel, densely, rugulose punctate.

♂. Anterior tarsal joints 1-3 with a comb along their inner edge; terminal dorsal segment entire. Genital armature (Pl. XII. fig. 34): lateral lobes moderately long; median lobe stout, abruptly acuminate and slightly curved at tip.

Length (excl. head) 9-10, breadth 2½-3 mm. (♂ ♀).

Hab. INDIA, Nepal (*Mus. Brit.*, *Mus. Oxon.*: ♂ ♀), W. Almora (*H. G. Champion*: ♂).

Ten specimens seen from Northern India, including the types from the Hardwicke collection in the British Museum. Various others from Belgaum and Madura (*Andrewes coll.*) and Bhotan (*Mus. Oxon.*), and Paungde in Burma (*Mus. Brit.*), are a little less elongate; but the genital armature of a ♂ from Belgaum being very similar (except that the

median lobe is less abruptly acuminate) to that of the Nepal and Almora insects, the southern examples are referred to the same species. A large, broad ♀ from the Anamalai Hills, and a small ♀ from the Nilgiris with the eyes more distant than usual, both in the Andrewes collection, may also belong here? Bourgeois's *I. melanura* was from Kunbir Nowatoli, that of Gorham from Belgaum and Madura. The type of *Diprosopus melanurus*, Muls., which has a testaceous labrum, was said to have been found at Nîmes, France; but there must have been some mistake as to this locality (see Jacquelin Duval, Gen. Coleopt. Europ. iii. p. 189).

#### 41. *Idgia melanura*.

*Deromma melanura*, Kollar and Redt. in Hügel's Kaschmir, iv. 2, p. 512, t. 25. fig. 6 (1844).

Extremely like *I. assimilis*, Hope, but with the head almost entirely, the antennæ (except at the tip), and legs (the bases of the femora excepted), black. Genital armature (Pl. XII. fig. 35): median lobe gradually narrowed into a long, blunt point.

*Hab.* N. INDIA, Cashmere [type], Kasauli (*H. J. W. Barrow*), Kangra and Palampur, Punjab (*G. E. Dudgeon*), Chitral (*R. Hill*), W. Almora (*H. G. Champion*: ♀), Gopaldhara in Sikkim (*H. Stevens*: ♂ ♀), N.W. Provinces (*coll. Andrewes*).

The numerous specimens from the above-mentioned localities in Northern India differ from the types of *I. assimilis*, Hope, in having the anterior portion of the head, as well as the basal portion of the antennæ, infusate or black, and the median lobe of the ♂ differently shaped. Bourgeois and Gorham included several species under the name *I. melanura*, as shown by the differences in the ♂-armature of the examples dissected, including a specimen from Sikkim of the present insect. The apical black patch is much smaller than in *I. melanocephala*, F., and the antennæ are more slender. The very elongate elytra are indicated in the figure in Hügel's work.

#### 42. *Idgia longissima*.

♂. *Idgia longissima*, Pic, Bull. Soc. Ent. Fr. 1909, p. 245; op. cit. 1910, p. 346.

♂. Antennæ long, slender, with joint 11 unusually elongate, about as long as 8-10 united (in ♀ shorter, and with joint 11 as long as 9 and 10 together); eyes very large,

contiguous (narrowly separated in ♀); anterior tarsal joints 1-3 with a comb along their inner edge. Genital armature: lateral lobes narrowed and sinuously curved towards the apex; median lobe broad, gradually narrowed, slightly hooked at the tip beneath.

*Hab.* SUMATRA, Padang [type], Sungei Kumbang, Siolak Daras, and Barong Bharu in Korinchi, alt. 3100-4500 ft. (*Robinson-Kloss Expedition*: iv. 1914).

Eleven specimens (5 ♂♂, 6 ♀♀) obtained by the above-mentioned Sumatran expedition are perhaps referable to *I. longissima*, Pic, type from Padang. Three only of them (♀♀), with a relatively shorter apical joint to the antennæ, have the legs wholly testaceous as described by the author, the others (♂♂) having these limbs in part or almost entirely, as well as the head in front and the antennæ (except at the tip), infusate or black. The greatly elongated eleventh antennal joint is one of the characters given to separate *I. longissima* from similarly coloured forms (testaceous, with black head and violaceous apex to elytra) inhabiting the same regions. In the series before me the apical patch varies in development, from about one-eighth to nearly one-half the elytral length. To judge from Pic's table (1910) of the testaceous Javan and Sumatran representatives of the genus, *I. longipennis* and *I. longissima* may be based upon the two sexes of one variable insect. Unfortunately, the ♀ only of the form with pale legs and antennæ, with shorter apical antennal joint, is at present available for examination.

#### 43. *Idgia cyanura*, sp. n.

♀. Elongate, widened posteriorly, shining, the elytra dull; finely pubescent and sparsely nigro-setose; testaceous, the head, antennæ (except the basal joints and the tip of 11), legs (the bases of the femora and the claws excepted), and a space down the middle of the ventral segments black, the elytra with a large nigro-cyanaceous patch at the apex. Head small, the labrum strongly transverse, hollowed in the middle in front, appearing subarcuate; eyes large, well separated; antennæ slender, rather short, slightly widened outwards, joints 7-10 decreasing in length, 10 subserrate, 11 twice as long as 10, deeply excavate within. Prothorax wider than the head, not longer than broad, feebly sinuate at the sides. Elytra long, rather broad, widened posteriorly; densely, rugulosely punctate, without granules on the disc.

Length (excl. head)  $8\frac{1}{2}$ , breadth 3 mm.



*Hab.* CEYLON, Kandy (G. E. Bryant: vi. 1908).

Very like *I. dimelana*, Walk., but with the antennæ and legs in great part, and the labrum, infusate or black, the apical patch on the elytra as large as in *I. melanocephala*, the head small, the labrum short and subarcuate, the penultimate antennal joint subserrate. *I. cyanura* cannot be satisfactorily included under *I. assimilis* or *I. melanura*, and as these latter are not known from Ceylon, a name is required for it, even in the absence of the male. *I. submetallica*, Pic (1911), also from Kandy, is similarly coloured above, but it has the under surface metallic.

#### 44. *Idgia dimelana*.

*Thacona dimelana*, Walk. Ann. & Mag. Nat. Hist. (3) iii. p. 260 (1859) [sub (Edemeridæ)]<sup>1</sup>.

*Idgia cardoni*, Bourg. Compt. rend. Soc. Ent. Belg. xxxv. p. cxli (1891) (♂ ♀)<sup>2</sup>, and Ann. Soc. Ent. Belg. xxxvi. p. 237 (1892)<sup>3</sup>; Gorb. op. cit. xxxix. p. 319 (1895)<sup>4</sup>.

♂. Anterior tarsal joints 1-3 with a black comb along their inner edge; terminal dorsal segment narrowly, deeply excised in the middle (the notch much deeper than in ♀), appearing bilobed at tip; sixth ventral segment triangularly emarginate. Genital armature (Pl. XII. fig. 36): lateral lobes very long; median lobe very elongate, almost straight from near the base, the apex abruptly drawn out into a long slender curved point.

*Hab.* S. INDIA (W. Davison), Bombay, Malabar (Mus. Brit.), Kunbir Nowatoli<sup>2</sup>, Mandar<sup>3,4</sup> (sec. Bourgeois), Belgau<sup>4</sup>, Madura (H. E. Andrewes), Anamalai Hills (H. L. Andrewes), Nilgiri Hills (H. L. Andrewes, Sir G. F. Hampson); CEYLON<sup>1</sup> (Thwaites, G. Lewis), Colombo (H. P. Green), Madulsima (F. B. Fletcher), Hapulahani (Mus. Brit.), Kandy (G. E. Bryant).

A common insect in Ceylon and Southern India, females greatly preponderating in the long series before me. One of Walker's types from Ceylon and a Nilgiri example have been dissected, and these show a precisely similar genital armature in ♂. The wholly testaceous labrum, antennæ, and legs, the slender antennæ, and the simple posterior femora in ♂, are its chief characters, but there are several very similar forms in the same regions. The apical black patch varies in size, but it is never very small. The length (excl. head) ranges from 9-10½ mm. The eyes are large and subcontiguous in ♂, the head is rather small, and not much elongated anteriorly, and the antennæ are slender.

The three females seen from Mandar (*P. Cardon*), all of large size, have stouter antennæ, and they may belong to a different species? *I. gorhami*, Pic, is a colour-variety of *I. dimelena*, see ante, p. 347, though the former is here given specific rank.

45. *Idgia flavibuccis*.

*Idgia flavibuccis*, Bourg. Ann. Soc. Ent. Belg. xxxvi. p. 237 (1892) (♂ ♀).

♂. Eyes extremely large, almost contiguous (narrowly separated in ♀); antennæ moderately elongate, a little longer than in ♀, distinctly thickened outwards, joints 7-10 gradually decreasing in length, 11 concave within, curved, nearly as long as 9 and 10 united; anterior tarsal joints 1-3 with a black comb along their inner edge. Genital armature (Pl. XII. fig. 37): lateral lobes sinuous within and curved inward at the tip, as seen from above; median lobe almost straight, drawn out into a curved point at the apex.

*Hab.* INDIA, Mandar in Western Bengal (*Cardon*: type), Bhutan (*Dr. Pemberton*, in *Mus. Brit.*: ♂ ♀).

This is a form of the variable *I. dimelena*, Walk. (= *cardoni*, Bourg.), with the head wholly testaceous, a  $\Lambda$ -shaped black mark between the eyes excepted, the antennæ shorter and not so slender, and the terminal dorsal segment of the abdomen entire. The median lobe is very similar in the two insects.

46. *Idgia luteipes*, sp. n.

♂. Elongate, narrow, feebly shining, finely pubescent, and sparsely nigro-setose; testaceous, the head (the labrum and anterior portion of the epistoma excepted), and a rather large apical patch on the elytra, black. Head slightly produced anteriorly, the labrum transverse, trapezoidal, excavate; eyes very large, almost contiguous; antennæ long, slender, filiform, joints 3-10 subequal in length, 11 concave, a little longer than 10. Prothorax longer than broad, scarcely wider than the head, strongly sinuate at the sides posteriorly, rugulose punctate. Elytra long, subparallel, densely, rugulose punctate, without seriatly-arranged granules on the disc. Anterior tarsal joints 1-3 with a narrow black comb along their inner edge; terminal dorsal segment deeply emarginate. Genital armature (Pl. XII. fig. 38): lateral lobes stout, long; median lobe drawn out into a long, slender, sinuate point, which is armed with a sharp, backwardly-directed tooth at the tip above.

Length (excl. head)  $7\frac{1}{2}$ , breadth  $2\frac{1}{2}$  mm.

*Hab.* S. INDIA, Nilgiri Hills (*A. K. Weld Downing*),  
Anamalai Hills (*H. L. Andrewes* : type).

Three males, one from each locality dissected, showing a precisely similar genital armature. Extremely like *I. dimelena*, but separable therefrom by its narrower form, smaller size, the excavate labrum, and the slender, sinuate, sharply hooked apical portion of the median lobe.

47. *Idgia indicola*, sp. n.

♂. Elongate, narrow, shining, the elytra duller; finely pubescent and sparsely nigro-setose; testaceous, the head (the labrum and anterior margin of the epistoma excepted), and a rather large apical patch on the elytra, black. Head short, the labrum transverse, flat; eyes very large, narrowly separated; antennæ slender, filiform, moderately long, joint 11 concave, one-half longer than 10. Prothorax slightly wider than the head, longer than broad, strongly sinuate at the sides posteriorly, rugulosely punctate. Elytra long, parallel, densely, rugulosely punctate, without granules on the disc. Anterior tarsal joints 1-3 with a narrow black comb along their inner edge; terminal dorsal segment narrowly, deeply excised. Genital armature (Pl. XII. fig. 39): lateral lobes long; median lobe, as seen in profile, stout, compressed, and obliquely sloping from a little beyond the middle, the apex drawn out into a short, curved, downwardly-directed point.

Length (excl. head) 8, breadth  $2\frac{1}{2}$  mm.

*Hab.* INDIA, Nilgiri Hills, Teppukadu, alt. 2500 ft. (*H. L. Andrewes*).

One male. Extremely like *I. luteipes*, but with the anterior portion of the head a little shorter, the labrum flat, the elytra slightly narrower (appearing more elongate), and the median lobe very differently shaped. From *I. dimelena*, ♂, the strongly sinuate sides of the prothorax, the narrow, parallel elytra, and the very different genital armature will serve to distinguish the present species. *I. puncticollis*, Bourg. (1903), length 10-12 mm. (♂ ♀), said to be a common insect "at light" at Pondichery and Mahé, must have a rougher prothorax and shorter antennæ; it has not been identified in the material examined by myself.

48. *Idgia rostrifera*, sp. n.

♀. Elongate, rather dull, thickly pubescent, and sparsely setose; obscure rufo-testaceous, the head (the epistoma and labrum in great part excepted), scutellum, a patch at the apex of the elytra, the sixth ventral segment, and apices of the femora black, the tarsi slightly infusate. Head long, narrow, the mandibles, epistoma, and labrum elongated, the labrum distinctly longer than broad, foveate in front; eyes large, separated by a rather wide space; antennæ long, slender, filiform, joint 11 constricted at the middle, a little longer than 10. Prothorax longer than broad, much wider than the head, very uneven, and closely, rugulosely punctate. Elytra long, subparallel, densely, rugulosely punctate, and with the usual rows of granules on the disc.

Length (excl. head) 9, breadth 3 mm.

*Hab.* INDIA, Anamalai Hills (*H. L. Andrewes*).

One specimen. Separable from *I. melanura* and *I. assimilis*, and all the similarly coloured Indian forms known to me, by the anteriorly elongated, subrostrate head, the labrum being longer than broad and foveate in the centre in front. The larger size, black knees and sixth ventral segment, elongate labrum, &c., distinguish *I. rostrifera* from *I. luteipes*, which was found by Mr. Andrewes in the same locality. The Arabian *I. arabica* and *I. laticornis* have a similarly elongate head.

49. *Idgia maindroni*.

*Idgia maindroni*, Fie, Bull. Soc. Ent. Fr. 1909, p. 245.

♂. Anterior tarsal joints 1-3 with a comb along their inner edge; terminal dorsal segment broadly subtruncate at tip. Genital armature (Pl. XII. fig. 40): lateral lobes broad, moderately long; median lobe broad, as seen from above, abruptly acuminate and hooked at the tip.

*Hab.* S. INDIA, Wallardi in Travancore [type], Nilgiri Hills (*H. L. Andrewes*: ♂ ♀).

A pair from the Nilgiri Hills are referred to this species. They are very like the larger examples of *I. dimelena*, Walk. (= *cardoni*, Bourg.), but have the head more produced in front and testaceous from the eyes forward, the latter very large in ♂; the elytra relatively longer, more shining, distinctly tricostate on the disc, and with a small black spot at the tip; and the pubescence longer, with very few setæ intermixed.

50. *Idgia nitida*, sp. n.

Elongate, narrow, shining, finely pubescent, and very sparsely setose; testaceous, the head between and behind the eyes, and a small apical patch on the elytra, black. Head slightly produced in front, grooved between the eyes, the labrum transverse, convex; eyes very large, subcontiguous in ♂, more distant in ♀; antennæ slender, subfiliform, joint 11 concave, a little longer than 10. Prothorax about as long as broad, not wider than the head in ♂, broader in ♀, feebly sinuate at the sides posteriorly. Elytra elongate, finely, closely, but not very densely punctate, the interspaces shining. Legs slender.

♂. Anterior tarsal joints 1-3 with a black comb along their inner edge; posterior tibiæ very slightly curved; terminal dorsal segment rounded at tip. Genital armature: lateral lobes rather short; median lobe drawn out into a long, narrow, slightly curved point.

Length (excl. head)  $8\frac{1}{2}$ - $10\frac{1}{2}$ , breadth  $2\frac{1}{2}$ - $3\frac{1}{2}$  mm. (♂ ♀.)

Hab. INDIA (*Stebbing*), Karachi (*T. R. Bell*), Lahore (*coll. Andrewes*).

Six females and two males, both the latter in a bad state of preservation, the locality on Mr. Stebbing's specimens illegible. Separable from the numerous similarly coloured forms by the rather sparsely punctate, shining elytra, and the wholly testaceous antennæ, ante-ocular portion of the head, and legs.

51. *Idgia fruhstorferi*.

*Idgia fruhstorferi*, Pic, L'Echange, xxvi. p. 76 (1910); Bull. Soc. Ent. Fr. 1910, p. 346.

Elongate, narrow, shining, finely pubescent, and sparsely fusco-setose; testaceous, the head (the epistoma and labrum excepted), and a small spot at the tip of the elytra, black. Head a little produced in front, the labrum transverse; eyes very large, contiguous in ♂, narrowly separated in ♀; antennæ long, slender, joint 11 hollowed within and at least twice as long as 10. Prothorax longer than broad, about as wide as the head, sinuate at the sides posteriorly. Elytra very elongate, densely, finely punctate.

♂. Anterior tarsal joints 1-3 with a black comb along their inner edge; sixth ventral segment triangularly emarginate. Genital armature (Pl. XII. fig. 41): lateral lobes long, strongly sinuate (as seen from above), incurved and

blunt at the tip; median lobe feebly sinuate, drawn out into a curved point at the apex.

Length (excl. head) 8-9½, breadth 2½ mm. (♂ ♀.)

Hab. JAVA (*Bowring, Horsfield*).

Four specimens, two of each sex, are referred to *I. fruhstorferi*, Pic, but they differ from his second amended definition in having the head infuscate behind the eyes, which is certainly a variable character. A ♀ from Tenasserim may also belong to the same species? The small apical spot, the wholly testaceous labrum, antennæ, and legs, the long apical joint to the antennæ, and the form of the lateral lobes of the ♂-tegmen are its chief characters. The slender posterior femora of the male separates the present insect from *I. bourgenisi*, Pic (1906), from the same island, as well as from *I. flavilabris*, from Perak and Penang.

## 52. *Idgia apicata*.

*Idgia apicata*, Gorb. Ann. Soc. Ent. Belg. xxxix. p. 320 (1895).

♂. Anterior tarsal joints 1-3 with a black comb along their inner edge; sixth ventral segment triangularly emarginate at tip. Genital armature (Pl. XII. fig. 42): lateral lobes long, broad, sinuous on their inner edge above, slightly hollowed near the tip beneath, the apices incurved and obtuse as seen from above; median lobe sinuate, drawn out into a curved point at apex.

Hab. MALACCA, Singapore (*A. R. Wallace*: ♂ ♀).

Two specimens, ♂ ♀, in the Oxford Museum, from the same source as the type, are presumably referable to *I. apicata*. A narrow, testaceous form, with the head (the anterior portion excepted) and the tips of the elytra black; the antennæ long and slender, with joint 11 twice as long as 10, and hollowed within; the eyes very large, contiguous in ♂, very narrowly separated in ♀; the elytra somewhat produced at the tip, and with the blackish setæ long and very conspicuous.

## 53. *Idgia dohertyi*.

*Idgia setifrons* (Kirsch), var. *dohertyi*, Pic, Bull. Soc. Ent. Fr. 1912, p. 300.

♂. Elongate, narrow, shining, finely pubescent, and sparsely fusco-setose; pale testaceous, the head around the eyes (in one specimen in great part, the anterior portion excepted), the eyes themselves, and the tips of the elytra,

infusate or black. Head a little produced anteriorly, the labrum transverse; eyes very large, almost or quite contiguous; antennæ long, slender, joint 11 hollowed on its inner face, at least twice as long as 10. Prothorax longer than broad, about as wide as the head, sinuate at the sides posteriorly. Elytra long, densely, finely punctate. Anterior tarsal joints 1-3 with a black comb along their inner edge. Sixth ventral segment triangularly emarginate. Genital armature (Pl. XII. fig. 43): lateral lobes long, sinuous on their inner edge above, obliquely truncate on their lower edge before the tip, the apices narrow, curved, and somewhat pointed; median lobe almost straight, gradually tapering to a curved point.

Length (excl. head)  $6\frac{3}{4}$ -7, breadth  $2\frac{1}{4}$  mm.

*Hab.* MALACCA, Perak (*Doherty*: type).

Three males from Perak seem to be referable to *I. dohertyi*, Pic, which is treated by him as a pale-legged variety of *I. setifrons*, Kirsch. A form of *I. apicata*, Gorb., with the lateral lobes of the tegmen differently shaped, the basal portion of the head partly testaceous, the elytra more depressed and with their apices a little less produced.

#### 54. *Idgia varicornis*, sp. n.

Elongate, narrow, shining, finely pubescent, and very sparsely setose; luteous, the head and a spot on the apex of the elytra, the antennæ (joint 11 excepted), tibiae, and tarsi, and the apices of the femora above, infusate or black. Head rather short, the labrum transverse, small; eyes very large, almost contiguous in ♂; antennæ long, slender, joint 11 sinuate, about one-half longer than 10. Prothorax slightly longer than broad. Elytra densely, finely punctate.

♂. Anterior tarsal joints 1-3 with a narrow comb along their inner edge; sixth ventral segment triangularly emarginate. Genital armature (Pl. XII. fig. 44): lateral lobes moderately long, narrow, simple; median lobe almost straight from near the base, slightly curved and pointed at tip.

Length (excl. head)  $6-7\frac{1}{2}$ , breadth  $2-2\frac{3}{4}$  mm. (♂ ♀.)

*Hab.* TENASSERIM, Tavoy (*Doherty*: ♂ ♀); ASSAM, Sudiya (*Doherty*: ♀).

One male [type] and five females. A small, narrow, moderately elongate form, with the antennæ and legs partly infusate, the head and the tip of the elytra black, and simple lateral lobes to the ♂-tegmen. Near *I. apicata*, Gorb.

55. *Idgia atriceps*, sp. n.

Elongate, narrow, shining, finely pubescent, and sparsely fusco-setose; testaceous, the head, and a small dull spot at the tip of the elytra, black, the antennæ (joint 11 excepted), tibiæ, and tarsi infusate. Head rather long, the labrum transverse, small; eyes very large, contiguous in ♂, narrowly separated in ♀; antennæ long, slender, joint 11 hollowed within, twice as long as 10. Prothorax longer than broad, about as wide as the head, sinuate at the sides posteriorly. Elytra elongate, densely, finely punctate.

♂. Anterior tarsal joints with a comb along their inner edge; sixth ventral segment triangularly emarginate. Genital armature (Pl. XII. fig. 45): lateral lobes comparatively short, broad, sinuously curved as seen from above, hollowed on their lower edge before the tip; median lobe feebly curved, drawn out into a long, strongly arcuate point at the apex.

Length (excl. head),  $7-7\frac{1}{2}$ , breadth  $2-2\frac{1}{2}$  mm. (♂ ♀.)

*Hab.* BURMA (*Bowring*).

Two males and one female. Separable from the allied forms with partly infusate limbs, small apical spot, and long terminal joint to the antennæ, by the clear testaceous femora, black head, and ♂-armature. The elytra are much smoother than in *I. indicola* from the Nilgiris, and have a less developed apical patch. *Prionocerus* (*Deromma*) *setifrons*, Kirsch (1875), from Malacca, an insect not identified by myself, must be nearly allied to the present species.

56. *Idgia varipes*, sp. n.

♂. Elongate, very narrow, shining, finely pubescent, and sparsely setose; testaceous, the head, antennæ (joint 11 excepted), and tips of the elytra, the femora along their upper edge, and the tibiæ, and tarsi (the tips excepted), infusate or black. Head slightly produced anteriorly, the labrum trapezoidal, triangularly depressed in the middle; eyes very large, subcontiguous; antennæ long, slightly widening outwards, joints 3-10 elongate, 4 shorter than 3 or 5, 11 curved, a little longer than 10. Prothorax longer than broad, as wide as the head, constricted posteriorly. Elytra long, narrow, subparallel, densely, finely punctate.

♂. Anterior tarsal joints 1-3 with a narrow comb along their inner edge; sixth ventral segment triangularly emarginate. Genital armature (Pl. XII. fig. 46): lateral lobes rather short, almost straight, blunt at tip, closely ciliate



on their lower edge; median lobe \* drawn out into a short, feebly curved point at apex.

Length (excl. head)  $6\frac{1}{2}$ , breadth  $1\frac{1}{2}$  mm.

*Hab.* MALACCA, Penang (*H. N. Ridley*).

One male, received at the Museum in 1874. This insect has the general facies of *I. pallidicolor*, ♂, as here identified, differing from it in the distinctly longer, stouter, curved apical joint of the antennæ, the darker limbs, the simply emarginate sixth ventral segment, and different armature. *I. atriceps*, from Burma, has a more elongate apical joint to the antennæ, the head more produced anteriorly, the femora testaceous, and a dissimilar ♂-armature.

#### 57. *Idgia decolor*, sp. n.

Elongate, narrow, shining, finely pubescent, and sparsely fusco-setose; testaceous, the clytra paler and somewhat transparent, the tips of the latter and the head black, the antennæ and legs (the bases of the femora excepted) infusate. Head elongated anteriorly, the labrum about as long as broad; eyes very large, contiguous in ♂, narrowly separated in ♀; antennæ long, slender, joint 11 sinuate, concave within, about one-half longer than 10. Prothorax longer than broad, slightly wider than the head, sinuate at the sides posteriorly. Elytra long, densely, finely punctate.

♂. Anterior tarsal joints 1-3 with a comb along their inner edge; sixth ventral segment triangularly emarginate. Genital armature (Pl. XII. fig. 47): lateral lobes long, rather narrow, feebly curved, blunt at the tip; median lobe very long, slightly sinuate, drawn out into a short, curved point at apex.

Length (excl. head) 8-10, breadth  $2\frac{1}{2}$ -3 mm. (♂ ♀.)

*Hab.* BURMA, Karen Mts. (*Doherty*, type: ♂ ♀); TENASSERIM, Tavoy (*Doherty*: ♀).

One male and six females. Separable from its allies by the pallid, somewhat transparent elytra, with small apical spot, the elongate black head, the infusate antennæ and legs (the bases of the femora excepted), and the ♂-armature, which is very different from that of the allied Burmese *I. atriceps*, the latter also having a relatively longer apical joint to the antennæ. One of the females from Tavoy with wholly pale head (eyes excepted), and another (immature) with the legs and antennæ also testaceous, doubtless belong to the same species.

\* In the figure it is removed from its proper position and shown from the ventral aspect.

58. *Idgia angustata*, sp. n.

♂. Elongate, very narrow, shining, finely pubescent, and very sparsely nigro-setose; pale testaceous, the head (the labrum and anterior margin of epistoma excepted), and a nail, rounded, sharply defined spot at the tip of the elytra, black, the antennæ (except at the base and apex) slightly infusate. Head somewhat produced anteriorly, the labrum transverse, trapezoidal; eyes very large, subcontiguous; antennæ long, filiform, joint 11 sinuate, twice as long as 10. Prothorax longer than broad, about as wide as the head, sinuate at the sides posteriorly. Elytra very long, narrow, parallel, densely, finely punctate. Sixth ventral segment triangularly emarginate. Anterior tarsal joints 1-3 with a black comb along their inner edge. Genital armature Pl. XII. fig. 48): lateral lobes moderately long, sinuately curved as seen from above, deeply emarginate on the lower edge before the tip, the latter obtuse; median lobe curved, drawn out into a short arcuate point at the apex.

Length (excl. head)  $7\frac{1}{2}$ , breadth 2 mm.

Hab. N. BORNEO, Labuan (*Mus. Brit.*).

One male. Very like *I. pallidicolor*, Pic, but with a long, sinuate, apical joint to the antennæ and a simply emarginate sixth ventral segment. From the same sex of *I. dohertyi*, from Perak, the relatively narrower elytra and different ♂-armature will serve to distinguish the present insect. A female from Sarawak (*Wallace, in Mus. Oxon.*), with larger apical patch, may belong here?

59. *Idgia dubia*.

*Cantharis dubia*, Gyll. in Schönh. Syn. Ins. i. 2, p. 73, nota (1808).

*Idgia dubia*, Gemm. and Harold, Cat. Coleopt. vii. p. 1721 (1869).

"Elongata, pallide testacea, antennis, oculis, elytrorum apice pedibusque nigris.—Ind. or." [*Gyllenhal.*]

Hab. INDIA (*Mus. Brit.*), Patkai Mts., Assam (*Doherty*).

Two females in the Museum collection, with the head wholly testaceous (the eyes excepted), may belong to this species, but the dark mark on the vertex mentioned by Gyllenhal is wanting. They have the antennæ, knees, tibiæ, and a small spot at the tips of the elytra infusate or black, the antennæ a little shorter than in most of the allied forms, with the terminal joint excavate and about twice as long as the tenth. *I. dubia*, treated by Pic as a "species incerta," is compared by him with his *I. pallidicolor* from Java.

60. *Idgia pallidicolor*.

*Idgia pallidicolor*, Pic, L'Echange, xxii. p. 43 (1906); Bull. Soc. Ent. Fr. 1910, p. 346.

♂. Anterior tarsal joints 1-3 with a narrow black comb along their inner edge; terminal dorsal segment emarginate in the middle at tip; sixth ventral segment (Pl. XII. fig. 49 a) deeply, narrowly, obliquely bi-excised at apex, the median portion shorter than the broader, truncate, curved lateral portions. Genital armature (Pl. XII. fig. 49): lateral lobes long, narrow, more or less emarginate on their lower edge before the tip; median lobe long, almost straight, curved downward into a blunt point at apex.

*Hab.* JAVA [type], Depok (*G. E. Bryant*, 18. iv. 1909: ♂); SIAM, Renong (*Doherty*: ♂ ♀); MALACCA, Perak (*Doherty*: ♂ ♀), Penang (*G. E. Bryant*, x. 1913: ♂ ♀); BORNEO, Quop (*G. E. Bryant*, 27. iii. 1914: ♀); TENASSERIM, Tavoy (*Doherty*: ♂ ♀); BURMA, Karen Mts. (*Doherty*: ♂); ASSAM, Patkai Mts. (*Doherty*: ♀).

A small, narrow, shining, pale testaceous form, with the tips of the clytra black; the head usually infuscate around the eyes, sometimes wholly testaceous, or with the base black (those from Penang and Borneo); the basal joints of the antennæ, the tibiæ and tarsi, and in some specimens the apices of the femora also, infuscate, rarely entirely testaceous; the antennæ long and slender, with the almost simple apical joint about as long as the tenth; the eyes very large, approximate in ♂, narrowly separated in ♀. Amongst the numerous closely allied insects from the same region, *I. pallidicolor*, as here identified, is recognizable by the trilobed sixth ventral segment of the male, and the non-elongated eleventh antennal joint in the two sexes, a character used by Pic in his first table of the Javan and Sumatran forms. Males from the localities quoted have been dissected: those from Java, Tenasserim, and Burma agree *inter se*; but the one from Penang (with blacker head) has the median lobe of the last ventral segment notched in the middle, that from Perak having the corresponding lobe longer, narrower, and rounded at the tip.

61. *Idgia dasytoides*, sp. n.

♀. Elongate, very narrow, slender, moderately shining, closely cinereo-pubescent, and sparsely nigro-setose; green or brassy-green, the antennæ piceous, the basal joints and

tip, and the palpi also, testaceous; the head and prothorax closely, minutely, the elytra densely, rugulosely punctate, the latter with seriatly-arranged raised granules extending down the disc. Head somewhat produced in front, narrow; eyes moderately large, distant, emarginate; apical joint of maxillary palpi elongate-triangular; antennæ very slender, long, joints 4-6 gradually increasing, and 7-10 rapidly decreasing, in length, 3 and 4 subequal in length, 11 as long as 10, constricted at the middle. Prothorax a little longer than broad, the sides rounded anteriorly and feebly sinuate before the base, the disc canaliculate. Elytra long, subparallel, much wider than the prothorax, rounded at the tip. Legs long, very slender; tarsal claws widened in their basal half.

Length (excl. head) 5, breadth  $1\frac{1}{2}$  mm.

*Hab.* BURMA, Karen Mts. (*Doherty*).

Six examples. This species has the general facies of a *Dasytes*, from which it is readily distinguished by the emarginate eyes, a character bringing *I. dasytoides* into the "Prionocerides" of Lacordaire. In the absence of the male, it can remain under *Idgia* for the present, the Chinese *I. flavirostris*, Pasc., having similar tarsal claws, slender legs and antennæ, a small head, &c.

Alphabetical numbered list of the species of *Prionocerus* and *Idgia* enumerated in this paper, the generic name indicated of those placed under the first-named genus; the new names marked with an asterisk:—

- |   |                    |
|---|--------------------|
| *abyssinica, 5.                           | *dichroa, 37.      |
| andrewesi, 20.                            | dimclena, 44.      |
| *angustata, 58.                           | dimidiata, 2.      |
| apicalia, 4.                              | dohertyi, 53.      |
| apicata, 52.                              | dubia, 59.         |
| *arabica, 9.                              | *femorata, 24.     |
| assimilis, 40.                            | flavibuccia, 45.   |
| *striceps, 55.                            | flavicollis, 13.   |
| belli, 18.                                | *flavilabris, 35.  |
| bicolor ( <i>Prionocerus</i> ), 2.        | flavirostris, 14.  |
| *ceruleiventris, 27.                      | *flavolimbata, 32. |
| *cavilabris, 28.                          | fruhstorferi, 51.  |
| chloroptera, 21.                          | fulvicollis, 8.    |
| coeruleipennis ( <i>Prionocerus</i> ), 1. | *geniculata, 36.   |
| cyanea, 7.                                | gorhami, 25.       |
| *cyanocephala, 22.                        | *indicola, 47.     |
| *cyanura, 43.                             | *javana, 30.       |
| *dasytoides, 61.                          | *laticornis, 10.   |
| *decolor, 57.                             | *longipalpis, 6.   |
| deusta, 11.                               | longissima, 42.    |

\*luteipes, 46.  
 \*maculiventris, 34.  
 \*maindroni, 49.  
 \*marginata, 31.  
 \*melanocephala, 39.  
 \*melanura, *Kollar & Redt.*, 41.  
 \*nilgirica, 26.  
 \*nitida, 50.  
 \*pallidicolor, 60.  
 \*plectrophora, 1.  
 \*rostrifera, 48.  
 \*rouyeri, 23.  
 \*semitecta, 38.  
 \*terminata, 3.  
 \*triserrata, 16.  
 \*uncigera, 29.  
 \*ungulata, 12.  
 \*varicornis, 54.

\*varipes, 56.  
 \*virescens, 15.  
 \*viridescens, 19.  
 \*viridipennis, 17.  
 \*viridivittata, 33.

#### SYNONYMS and VARIETIES.

brevicornis (*Prionocerus*), 1.  
 \*caeruleatus, 18.  
 \*cardoni, 44.  
 \*ceylonica, 39.  
 \*diversipennis, 25.  
 \*forticornis (*Prionocerus*), 1.  
 \*fuscipennis (*Prionocerus*), 1.  
 \*melanura, *Muls. & Bourg.*, 40.  
 \*metallescens, 19.  
 \*notaticollis (*Prionocerus*), 2.  
 \*tripartita, 2.

#### EXPLANATION OF PLATES XI. & XII.

*Figs. 1-49.* Profile views of the ♂ genital armature of species of *Prionocerus* and *Idgia*, one only of the lateral lobes shown and the free tubular median lobe lowered from its normal position, so that a clearer outline could be given of it, the apical portion of the sac (when visible in the dried specimens) added; 9a and 10a, dorsal views of 9 and 10, the median lobe omitted in 9a; 49a, sixth ventral segment of *I. pallidicolor*, ♂; 50, apices of elytra of *I. uncigera*, ♀; all × 12. In fig. 46 the median lobe is out of its normal position, and shown from the ventral aspect.

#### XXXIV.—A Note on the Egg-burster of *Eucephalous Fly-larvæ*. By F. W. EDWARDS.

In widely separated divisions of the animal kingdom special embryonic organs are found whose function is to facilitate the hatching of the embryo from the egg. Everyone is familiar with the hard knob which occurs on the tip of the upper jaw in the chick as well as in other oviparous vertebrates. Among the *Insecta* egg-bursting organs are often found on the dorsal surface of the head, and assume a variety of forms. Different types have been described by Packard ('Text-book of Entomology,' p. 585), Berlese ('Gli Insetti,' vol. 2, p. 218), and Williams and Buxton (Trans. Ent. Soc. London, 1916, p. 88). In other cases these organs appear to be part of the amnion rather than of the embryo itself; instances of this are given by Riley (*vide* Packard, Text-book, p. 585) and Kershaw (Bull. Trinidad Dept. Agric. xii. 1913, p. 94).

In regard to the Diptera, I have only succeeded in tracing two published references to an egg-burster, both relating to the Culicidæ. Howard, Dyar, and Knab, in their 'Mosquitoes of North and Central America and the West Indies,' say (vol. i. p. 97):—

"The first-stage larva may be recognized by the presence on the head of the egg-burster. This is situated dorsally on the middle of the head and consists of an oval, pale, depressed area, in the middle of which is situated a chitinous disc surmounted by a small black chitinous peg."

Scott Macfie (Bull. Ent. Res. vii. 1917, p. 298) says in regard to *Stegomyia fuscata*: "The 'egg-burster,' situated dorsally about the middle of the head, is a conspicuous feature in the first phase"; he also gives a figure which shows this organ, though not in any great detail.

In several Dipterous larvæ of different families which I have been able to examine, the egg-burster has a position and structure similar to that indicated by the above-mentioned authors for the Culicidæ. It is essentially the same in *Anopheles maculipennis*, *Aedes argenteus* (= *Stegomyia fuscata*), *A. (Ochlerotatus) geniculatus*, *Theobaldia annulata*, *Chaoborus* (= *Corethra) plumicornis*, *Simulium angustipes*, *S. austeni*, *Chironomus dorsalis*, *Botitophila pseudohybrida*, and *Trichonta* sp. In none of these cases does it resemble that of *Pulex canis*, described by Packard as "a thin vertical plate, like the edge of a knife."

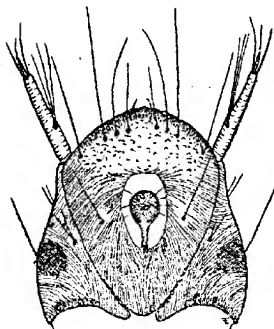
Though the list given above comprises all the species which I have observed, it is sufficiently comprehensive to warrant the belief that the egg-burster will be found to be present in a similar form in all the eucephalous larvæ of Nematocera, though it may not always be functional.

In every case all trace of the structure disappears after the first moult, though sometimes (at least in *Chironomus dorsalis* and *Aedes geniculatus*), and perhaps always, a minute black pigment-spot is observable under the cuticle of the second-stage larva in the position occupied by the egg-burster in the first stage.

In an egg which is about to hatch, the young larva can be observed (provided the shell is thin enough) moving its head up and down and cutting or scratching a slit in the shell. I have observed this process in *Botitophila pseudohybrida*, and in the newly-hatched larvæ of the same species have seen the egg-burster being raised and lowered. Presumably this latter movement also took place within the egg, though I was not able to observe it.

It would seem that the lowering of the egg-burster is

Fig. 1.

*Aedes geniculatus* (Olivier).

Dorsal view of head of first-stage larva, to show position and form of egg-burster: from a living specimen.  $\times$  about 60. (The shading is intended to represent fine ridges in the chitin, which occur over the greater part of the head.)

Fig. 2 a.



Fig. 2.

Fig. 2.—*Aedes argenteus* (Poirét) [*Stegomyia fasciata* auct.]. Egg-burster, seen from posterior end of head, showing thickness of disc and strong central peg.  $\times$  about 100.

Fig. 2 a.—The same, half side view. From cast skins; diagrammatic.

Fig. 3.

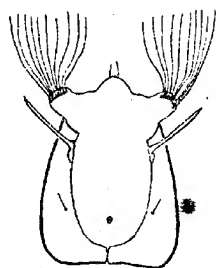
*Theobaldia annulata* (Schrank).

Sectional view (transverse) through egg-burster, showing attachment of muscles.  $\times$  about 120. From a balsam mount in the British Museum, prepared by Mr. W. D. Lang.

effected by a pair of muscles which are attached to the inside of the disc and pass across to the ventral side of the head. These muscles are easily seen in the perfectly transparent larva of *Chaoborus* (*Corethra*); they are shown also in the accompanying diagram of the egg-burster of *Theobaldia annulata*. Though they almost meet on the chitinous disc, the muscles are wide apart at their ventral insertion. I have not ascertained whether they persist beyond the first larval stage. One must suppose that the egg-burster is raised and so brought into use by blood-pressure on the relaxation of this pair of muscles.

The precise form of the chitinous disc varies somewhat in the different species examined. It is relatively larger and more conspicuous in the Culicidæ than in the Chironomidæ and Mycetophilidæ, while among the Culicidæ it is

Fig. 4.

*Simulium austeni*, Edw.

Dorsal view of head of newly hatched larva, showing minute egg-burster near posterior end of clypeus.  $\times$  about 60. From a spirit-specimen.

decidedly more heavily chitinised in *Aedes* than it is in *Theobaldia* or *Anopheles*. In *Aedes* it is connected by a narrow chitinous rod with the posterior part of the clypeus, the rod arising from a thickened bar in the chitin. I have not been able to detect this rod in other Culicidæ or in the other families examined. The eggs of *Aedes* have usually great powers of resistance to dessication, and probably on this account have a thick chorion, which necessitates a more efficient egg-burster.

The two species of *Aedes* examined show slight differences: the egg-burster in *A. argenteus* is nearer the posterior end



of the clypeus than it is in *A. geniculatus*\*, while in the latter species the chitinous disc bears a sharp transverse ridge on each side of the central peg.

In *Simulium austeni* the egg-burster is very small and inconspicuous, and appears to have no membranous area surrounding it, but this may not be the case throughout the genus. I hatched out in 1915 a number of young larvæ of *S. angustipes*, and, though these were not kept, my recollection of them is that they had egg-bursters as well developed as those of the Culicidæ. If this is so, it may be due to differences in breeding-habits between the two species.

The subject is one of considerable interest and will certainly bear further investigation.

XXXV.—*The Amphipod Orchestia tucurauna, Fritz Müller, of Brazil, redescribed from New Zealand Specimens.* By CHAS. CHILTON, M.A., D.Sc., LL.D., C.M.Z.S., Hon. Memb. Roy. Soc. N.S.W.

ON July 11th, 1910, I collected near the mouth of the Waitohi stream at Picton, New Zealand, several specimens of a sandhopper that I thought at the time would probably be *Orchestia chiliensis*, Milne-Edwards, which is common on the neighbouring shores of Queen Charlotte Sound and elsewhere on the New Zealand coasts. On examination, however, I found that, though two of the specimens were *O. chiliensis*, the others differed considerably from *O. chiliensis* in the shape of the second gnathopods of the male. One male specimen of these was dissected and mounted and to some extent examined, and was provisionally named *O. redmani*, sp. n., in my MS. in honour of Dr. Redman of Picton, to whom I am indebted for much assistance. I felt sure that I had seen somewhere a drawing of a gnathopod similar to the second gnathopod of this specimen, but at the time could not ascertain where this was; consequently the specimens were laid aside for a more favourable opportunity. Recently, in looking up Stebbing's paper in the *Trans. Linn. Soc.* vol. vii. p. 395, 1909, for another purpose, my attention was drawn to his figures of *O. sulensoni* (pl. xxx. C), owing to the

\* This character would appear to be variable, since the egg-burster is shown nearer the middle of the head in Scott-Macfie's figure than it appeared to be in the cast skins of the same species which I examined.

resemblance of the second gnathopod to that of my Picton specimens. A comparison of my specimens with Stebbing's description and figures of *O. sulensoni* made it appear very probable that they belonged to the same species, though the palm of the second gnathopod of *O. sulensoni* is shown considerably more oblique and that species was supposed to have been obtained at Madeira, the locality, however, being doubtful.

Stebbing states that his species agrees with the imperfectly described *O. tucurana*, Fritz Müller, in regard to the finger and the notched palm of the second gnathopods, but appears to differ in not having the fourth and fifth joints of the fifth peræopod thickened or broadened. In turning up Fritz Müller's reference to his specimen in 'Facts and Arguments for Darwin,' 1869, p. 79, I find that the second gnathopod of the male, as figured by Fritz Müller, agrees pretty closely with that of the Picton specimens, and that, moreover, the description given by Fritz Müller of the changes that take place in the males even after they attain sexual maturity and his account of the more immature males agree very well indeed with those exhibited by the Picton specimens. Thus I had already noted that in them the first few joints of the flagellum of the second antenna were more or less completely fused in the fully developed males and that in the young males the process on the finger and the corresponding notch on the palm of the second gnathopod were only slightly developed. There seems little doubt that the specimen described by Stebbing as *O. sulensoni* is really the same as Müller's *O. tucurana*. Stebbing's description of the various characters not mentioned by Fritz Müller agrees closely with the Picton specimens; thus, while the basal joint is oval in the third and fourth peræopods and partially so in the fifth, its hind margin in that limb is almost quite straight as described by Stebbing. In my specimens, in the better developed males the second antennæ are strong and have the last two joints of the peduncle considerably broadened, but in none of my specimens have I seen the fourth and fifth joints of the fifth peræopod specially broadened; they are comparatively slender, as drawn and described by Stebbing. I have little doubt, however, that Fritz Müller is right in saying that this character is shown only in the older males and is not fully developed until after they come to sexual maturity. I have often noticed the same thing in the nearly allied species *O. chiliensis*, M.-Edw., where the males may have the characteristic form of the second gnathopod and of the antennæ, though they have not yet developed the thickened

joints of the fourth and fifth peraeopods, this latter character being found in comparatively few individuals.

Consequently from a comparison of my specimens with the two descriptions as given by Müller and Stebbing I feel little doubt that they are sufficiently near to be considered as belonging to the same species, notwithstanding the widely separated localities from which they were obtained. Fritz Müller does not mention the locality from which he collected his species, but presumably it was obtained while he was living in South Brazil either at Blumenau or at Desterro. My Picton specimens were obtained on the banks of the Waitohi stream at some little distance from its mouth in a place that would not be affected by ordinary high tides, though it would be reached by unusually high tides. At the same time and place I collected specimens of *Porcellio scaber*, several beetles, spiders, &c.—animals not by any means confined to the sea-shore. I have never seen the species from any other part of New Zealand. Fritz Müller gives no particulars as to the conditions under which the specimens were collected, and the locality of the single specimen of *O. sulensoni* in the Copenhagen Museum described by Stebbing is uncertain, though it is supposed to have come from Madeira.

I am inclined to think that the single specimen from Kapiti Island described by Filhol as *Orchestia dentata* (1885, p. 462, pl. liii. fig. 1) belongs to *O. tucurauna*, but neither his description nor his figure is sufficient to make the identification certain\*.

The occurrence of *Orchestia tucurauna* both in South America and in New Zealand is interesting as another example of the connection between the two faunas; *O. chilensis*, M.-Edw., which was found at Picton along with

\* A few days after the MS. containing the statement above was posted I found a tube containing some Amphipods collected in 1906 by Dr. Cockayne at Kapiti Island "on rocks at base of a waterfall." Of the three specimens in the tube (the existence of which I had previously forgotten), one is a well-developed male of *O. tucurauna* agreeing well with the Picton specimens, the lower antenna being quite stout and the fifth peraeopods, though not showing any definite broadening, hardly as narrow as the Picton specimens. There can be little doubt, therefore, that *O. dentata*, Filhol, from Kapiti Island, is really the same as *O. tucurauna*, as I had suggested. Of the other two specimens, one is *Parorchestia rylvicola* (Dana), the land-hopper found all over New Zealand, often far from the sea, and the other is an imperfect specimen of *Orchestia chilensis*, M.-Edw.

It may be noted that both the Picton and the Kapiti Island specimens were obtained where the water was probably brackish or even fresh at the time; and I suspect that *O. tucurauna* will be found to be more or less confined to such localities.

*O. tucurauna* and is common on all New Zealand coasts, also occurs on the coasts of Chile, and, as I have pointed out elsewhere, numerous other Crustacea have a similar distribution—for example, the shore Isopod, *Deto bucculenta* (Nicolet), which is found in New Zealand (including the outlying Chatham Islands) and in Chile, South America (see Chilton, 1909 A, p. 602, 1909 B, p. 799, and 1915, p. 453).

I give below a specific diagnosis, with figures of the species *O. tucurauna*, and a few additional notes on its structure.

I wish to express my grateful thanks to my assistant, Miss E. M. Herriott, M.A., for the care she has taken in preparing the drawings for this paper.

*Orchestia tucurauna*, Fritz Müller. (Text-figs. 1-14.)

*O. tucurauna* (also printed *O. tucuratinga*), Fritz Müller, 1864, 'Für Darwin,' p. 54, figs. 50 & 51, and 1869, 'Facts and Arguments for Darwin,' p. 79, figs. 50 & 51.

*O. tucurauna*, Stebbing, 1906, p. 534.

*O. sulzenski*, Stebbing, 1899, p. 400, pl. xxx. c, and 1906, p. 541.

*O. redmani*, sp. n., Chilton, MS.

? *O. dentata*, Filhol, 1885, p. 462, pl. liii. fig. 1.

*Specific Diagnosis.*

*Male*.—Side-plates not deep, anterior lobe of side-plate of pereopod 3 much deeper than the posterior lobe. Pleon-segment 3 with postero-lateral angles quadrate, acute, scarcely produced, posterior margin with a few short setæ. Eyes of moderate size, round. Antenna 1 not reaching to end of penultimate joint of antenna 2, first joint as broad as long, second and third each a little longer than the preceding; flagellum of four to six joints, the first three being coalesced, subequal in length to the peduncle. Antenna 2 stout, last joint of peduncle longer and slightly more slender than the penultimate; flagellum subequal in length to the peduncle and of about twenty joints, the first four or five more or less completely coalesced, especially in old males. Gnathopod 1 with side-plate small, somewhat triangular, slightly produced anteriorly, its inferior margin bearing a few small setæ; basal joint narrow at base, widening distally, its anterior surface grooved; ischium without apical process; carpus with prominent, narrowly rounded, distal pellucid process; propod oblong, widening to the palm, and bearing distally a rounded pellucid process, palm not distinctly defined and overlapped by finger; all the joints beset with numerous short setæ. Gnathopod 2, basal joint narrow at the base, not broadening greatly distally, anterior surface grooved; carpus

very small, triangular; propod very large, broadly oval, widening slightly to the palm, both margins almost free from setæ, the hind one with a few small setæ towards distal end,

Fig. 1.

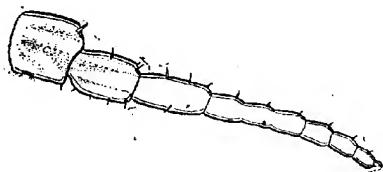
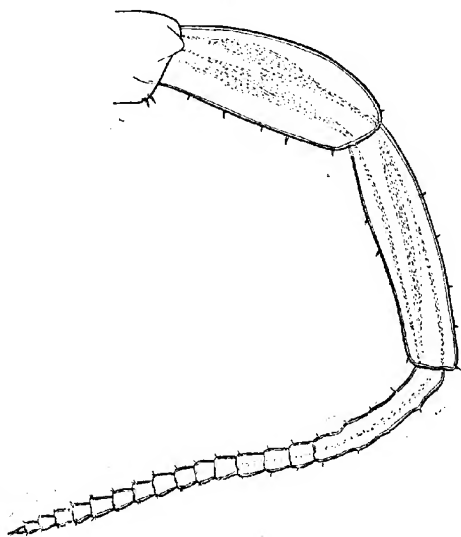


Fig. 2.



- Fig. 1.—*Orchestia tucurana*, first antenna of male.
- Fig. 2.—*Orchestia tucurana*, second antenna of male.

palm nearly transverse in old males, more oblique in younger individuals, spinulose, irregularly convex between the blunt defining tooth and a deep depression near the hinge; dactyl

Fig. 3.

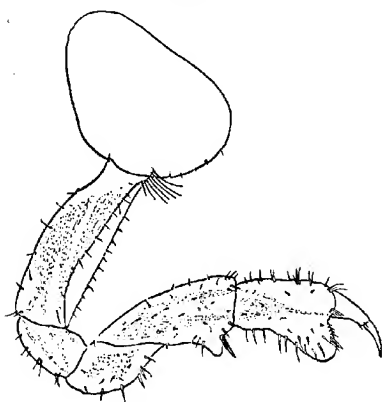


Fig. 4

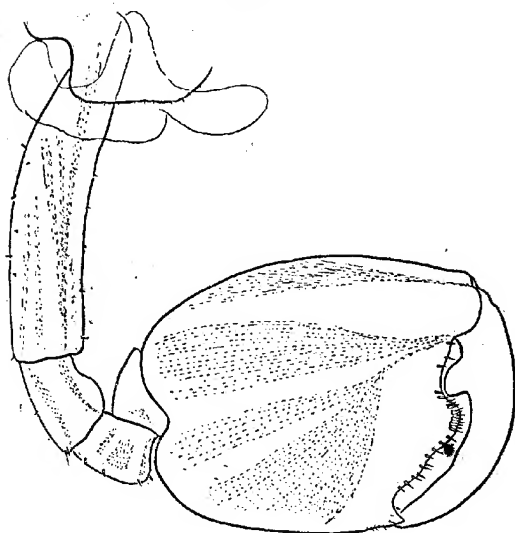


Fig. 3.—*Orchestia tucurauna*, first gnathopod of male.

Fig. 4.—*Orchestia tucurauna*, second gnathopod of male.

Fig. 5.

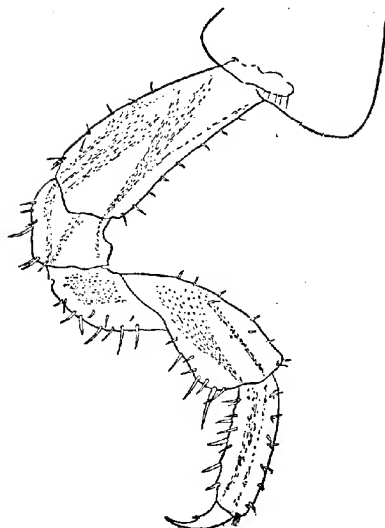


Fig. 6.

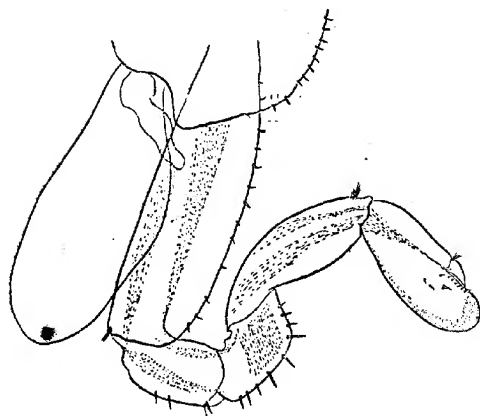


Fig. 5.—*Orchestia tucurauna*, first gnathopod of female.  
Fig. 6.—*Orchestia tucurauna*, second gnathopod of female.

Fig. 7.

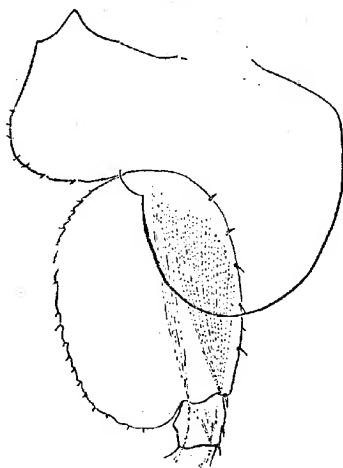


Fig. 8.

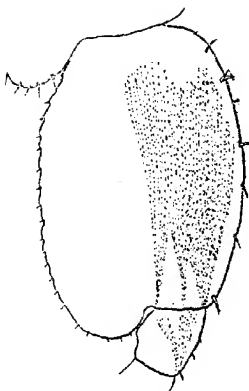
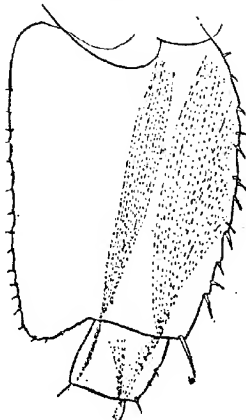


Fig. 9.



- Fig. 7.—*Orchestia tucurauna*, side-plate and basal joint of pereopod 3 of male.  
 Fig. 8.—*Orchestia tucurauna*, basal joint of pereopod 4 of male.  
 Fig. 9.—*Orchestia tucurauna*, basal joint of pereopod 5 of male.



large, strongly curved, its inner margin bearing a prominent convex process near the base, fitting into the depression in the palm. Peræopod 1 slightly longer than the second, which has the finger indented. Peræopods 3 and 4 with basal joint oval, larger and slightly narrower in the fourth

Fig. 10.

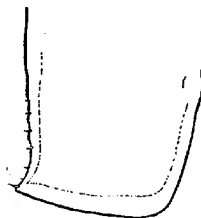


Fig. 12.



Fig. 11.

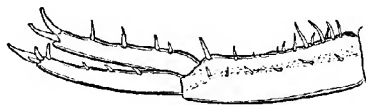


Fig. 13.



Fig. 14.



Fig. 10.—*Orchestia tucurauna*, inferior portion of third pleon-segment.

Fig. 11.—*Orchestia tucurauna*, first uropod.

Fig. 12.—*Orchestia tucurauna*, second uropod.

Fig. 13.—*Orchestia tucurauna*, third uropod.

Fig. 14.—*Orchestia tucurauna*, telson.

than in the third; basal joint of fifth with hind margin almost straight, posterior angle somewhat produced downwards; posterior margin in all serrate and with fine spinules; remaining joints in all rather slender in specimens examined,

but those of the fifth said to become broader in old males (Fritz Müller). Uropod 1 with peduncle scarcely longer than rami, its upper margin bearing numerous spines, both rami with lateral as well as terminal spines. Uropod 2 with rami about as long as peduncle, both with lateral and terminal spines. Uropod 3 with ramus about as long as peduncle, with spines on margin and at apex. Telson with posterior margin rounded and fringed with numerous spines, very slightly indented in middle.

*Female*.—First gnathopod with side-plate small, triangularly produced in front, carpus longer and slightly broader than the propod, which narrows distally, so that the joint is simple, without palm. Second gnathopod with basis of nearly same width throughout, broadened, but not greatly so; carpus and propod subequal, long-oval, posterior margin of carpus moderately and regularly convex. Peræopods as in male, but with the joints a little more slender. In other respects closely resembling the male.

Length of largest male examined about 14 mm.

*Locality*. Banks of Waitohi stream, Picton, at some distance from mouth; Rapiti Island (*Fihol*) (?).

*Distribution*. New Zealand, South Brazil, Madeira (?).

#### *Remarks.*

The mouth-parts are of the type usual in *Orchestia*, and do not call for detailed description. The palp on the first maxilla is minute, but distinct. In the largest male examined there appears to be an obscure rudiment of the fourth joint of the palp of the maxilliped, but I can find no sign of it in two other specimens mounted, viz., a male less developed and a female.

The New Zealand specimens appear to differ from Stebbing's description of the single specimen of *O. sulensoni* in having the first antenna slightly longer, the flagellum having more than four joints. In the first gnathopod the rounded lobe at the distal end is more distinct and in the second the palm is more transverse; both these differences are probably due to the fact that the type-specimen of *O. sulensoni* was hardly so mature as the Picton specimens. In the third uropod the ramus is as long as the peduncle; Stebbing describes it as "not half as long or half as broad."

Fritz Müller's account deals only with a few special points. His figure of the second gnathopod of the male does not show the tooth defining the palm, but the strongly marked convex

process on the base of the finger and the corresponding depression in the palm are quite the same as in the New Zealand specimens and are very distinctive of the species. His figure of the second gnathopod of the female shows the limb shorter and stouter and the basal joint much broader than in my specimens. As already mentioned, he states that in old males the joints of the fifth peræopod become broadened; this is not shown in any of my specimens nor in the type of *O. sulensoni*.

I do not consider these differences in the descriptions and figures sufficient to counterbalance the close resemblance in the distinctive character of the second gnathopod of the male, supported as it is by Müller's account of the coalescence of the basal joints of the flagellum of the second antenna and by the resemblances in other characters to those given by Stebbing for *O. sulensoni*.

*Orchestia tucurauna* appears to belong to that section of the genus containing *O. chiliensis*, M.-Edw., *O. miranda*, Chilton, and *O. platensis*, Krøyer, in which there is a tendency in the males for the second antenna to become stout and for some of the joints of the fifth peræopod to be broadened. *O. pickeringii*, Dana, should perhaps also be grouped in the same section.

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XXXVI.—*North Pacific Zoroasteridæ* \*. By WALTER K. FISHER, Director, Hopkins Marine Station of Stanford University, California.

STARFISHES of the family Zoroasteridæ are abundant on muddy bottom in deep water off the west coast of the United States, and form a very characteristic element of the fauna. While the species are not especially numerous, individuals apparently swarm in some localities, judging by the results of dredge-hauls.

In this paper one new species and three new subspecies are briefly diagnosed. Keys to the west American species of *Zoroaster* and *Myxoderma* will serve, it is hoped, to designate by contrast the characters of the new forms. A synopsis of the genera of Zoroasteridæ is included in order to present in compact form our present knowledge of the status of these groups. The anatomical details for which some novelty may be assumed will be dealt with in more detail in a monograph of Philippine and Moluccan sea-stars now in press.

Further study of *Myxoderma*, first proposed as a subgenus, has shown it to be very distinct from *Zoroaster*. The capture by the 'Albatross' of large examples of *Cnemidaster weyllii*, not a great distance from the type-locality, has thrown new light upon a genus which was based upon a young and wholly inadequate specimen. Very small examples of Zoroasteridæ are very different from the adults—in fact, they sometimes differ from the mature specimens in characters of generic importance! To put the matter more concretely, very young *Zoroaster* has all the adambulacral plates subequal (= *Prognaster* stage), which is true also of little examples of *Cnemidaster*. The latter lack also adradial plates, the presence of which is about the only constant character by which the adult can be distinguished from *Mammaster*.

I have not seen a specimen of *Prognaster*. Perrier confused the matter by publishing a second description with virtually a second type, *P. longicauda*, which appears to be a slender-rayed *Zoroaster*.

#### *Synopsis of the known Genera of Zoroasteridæ.*

- a. Dorsal surface not devoid of spines and not covered with a smooth tough membrane, in sharp contrast to the spinous or squamiferous actinolateral regions.

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\* Published with permission of the U.S. Commissioner of Fisheries.

- b'. Superambulacral plates absent, no conspicuous buttress extending from the upper enlarged end of the first two pairs of ambulacral plates to the body-wall at the interradial angle.
- c'. All adambulacral plates carinate on the furrow face. Genotype, *Prognaster grimaldii*, Perrier ..... *Prognaster*\*, Perrier.
- c<sup>2</sup>. Adambulacral plates alternately carinate and non-carinate.
- d'. Rays long, slender; disk small; abactinal, marginal, and actinolateral plates arranged in regular longitudinal lines along ray, a series of adradial plates being always present; all but the median radial or carinal, which are larger, form also transverse series; plates are covered with small, papilliform, skin-covered spinelets, and most of them bear an enlarged spine; papular areas generally very small but sometimes nearly as large as plates; forficiform pedicellariæ present; actinolateral plates in three to five series, the upper subequal to the inferomarginal plates; superomarginal plates not conspicuously larger than the inferomarginal plates. Genotype, *Zoroaster fulgens*, Thomson. . . . . *Zoroaster*, Thomson.
- d<sup>2</sup>. Plates of ray arranged in regular longitudinal series, the carinal plates the largest; abactinal and marginal plates armed with fairly large, skin-covered scales which mask all plates except some of the disk-plates and the carinal series along ray; no pedicellariæ; actinolateral plates, in two or three series, much smaller than inferomarginals; superomarginal plates much larger than inferomarginal plates. Genotype, *Pholidaster squamatus*, Sladen. . . . . *Pholidaster*, Sladen.
- b<sup>2</sup>. Superambulacral plates present; a conspicuous buttress, the specialized first superambulacral plate connects the upper end of the first two ambulacral plates with the body-wall at interradial angle.

\* *Prognaster*, Perrier, 'Comptes rendus,' cxii. no. 21, May 5, 1891, p. 1226. Type, *P. grimaldii*. Also 'Résultats des campagnes scientifiques du Prince de Monaco,' fasc. xi. 1896, p. 22, pl. ii. figs. 1, 1 a-b. In the meantime, Perrier described *Prognaster* as a new genus with *P. longicauda*, new species, ostensibly as type (Expéd. scientif. du 'Travailleur' et du 'Talisman,' 1894, p. 119). This species does not seem to be congeneric with *grimaldii*, which, of course, is the genuine genotype.

- c'. Adradial plates present; two series of papular areas between the carinal and superomarginal plates, the latter never conspicuously enlarged nor overlapping the carinals. Genotype, *Zoroaster saccatus*, Fisher. . . . . *Myzoderma*\*, Fisher
- c". No adradial plates; one series of very small adradial papular pores; superomarginal plates of two sizes, alternately larger and smaller, overlapping the carinals strongly and dominating these plates, which are sunken below the level of the superomarginals. Genotype, *Bythiophus acanthinus*, Fisher. . . . . *Bythiophus*†, F.sher.
- d'. Abactinal plates of disk, the carinals, adradials (when present), marginals, and sometimes one series of actinolateral plates devoid of spines or any conspicuous armature, but mostly smooth and covered with a tough membrane of variable thickness, often partly obscuring the plates; two to four lower series of actinolateral plates covered with squamiform fleshy spinelets and sometimes a conspicuous appressed spine; superambulacral plates present, the first conspicuously enlarged into a buttress connecting the upper end of the first two ambulacral ossicles with the body-wall.
- d". With a series of adradial plates more or less well developed; four or five series of actinolateral plates. Genotype, *Cnemidaster icypillii*, Sladen. . . . . *Cnemidaster*†, Sladen.
- e'. Adradial plates absent, the inner lobe of the superomarginal plates overlapping the carinal plates; three series of actinolateral plates with rudimentary fourth series in large specimens. Genotype, *Zoroaster sigsbeei*, Perrier. . . . . *Mammaster*, Perrier.

*Key to the North Pacific Species and Subspecies of Zoroaster.*

- a'. With four series of actinolateral plates on proximal part of ray; dorsolateral and intermarginal papular areas very small with normally one papula each; inferomarginal and actinolateral spines slender, closely appressed.

\* *Myzoderma*, Fisher (subgenus), Bull. Bureau Fisheries, 1904, vol. xxiv., June 10, 1905, p. 316.

† *Bythiophus*, Fisher, 'New East Indian Starfishes,' Proc. Biol. Soc. Washington, vol. xxix., Feb. 24, 1916, p. 31.

‡ I have examined large adult specimens. Sladen's type was small, very immature, and therefore had not developed some of the characters of the adult.

- b*<sup>1</sup>. Supermarginal spines very slender, appressed; no adradial spines; ten carinal plates correspond to fourteen adradial and fourteen supermarginal plates; fourth or lowest actinolateral series extending far along ray; plates of first two actinolateral series as broad as inferomarginals; adradial plates broadly overlapped by adjacent series ..... *ophiurus*, Fisher.
- b*<sup>2</sup>. Supermarginal spines more robust, often bristling; an incomplete series of adradial spines; ten carinal plates correspond to nineteen adradial and nineteen supermarginal plates; fourth or lowest actinolateral series short (one-sixth length of ray); plates of first actinolateral series, only, as broad as the inferomarginals; adradial plates exposed (about 50 per cent. broader than in *ophiurus*) ..... *actinocles*, sp. n.
- a*<sup>2</sup>. With three series of actinolateral plates; the two dorso-lateral and the intermarginal series of papular areas with two to four papulae, the areas rather large; all spines rather long and bristling.
- b*<sup>1</sup>. No large pedicellaria regularly on the second spine of the prominent or carinate adambulacral plates ..... *evermanni*, Fisher.
- b*<sup>2</sup>. A large pedicellaria regularly present on the second spine (from furrow) of the prominent or carinate adambulacral plates ..... *mordax*, subsp. n.

*Zoroaster actinocles*, sp. n.

Rays 5.  $R=161$  mm.,  $r=11$  mm.,  $R=14.6r$ ; breadth of ray at base, 13 mm. Rays slender, evenly tapered to the extremity, which is capped by a relatively large terminal plate; disk elevated at centre; carinal ridge rather prominent. Resembling a slender-rayed *Z. fulgens*, but differing in having the plates of the second, third, and fourth actinolateral series smaller, the fourth series being rudimentary; in having slenderer supermarginal spines (which are decidedly slenderer than the carinal spines), fleshier spinelets, relatively larger carinal plates, never but one actinolateral spine to a plate; in having a decidedly larger terminal plate, and a large pedicellaria on the second (from furrow) adambulacral spine. The papular pores are small; there are five regular longitudinal series, with the beginning of a sixth at base of ray, on either side of the carinal plates—namely, two dorso-lateral, one intermarginal, 2+1 incomplete actinolateral series. Papulae solitary and small. Carinate or prominent

adambulacral plates with a transverse series of five spines, the first deep in furrow, the second with a pedicellaria about 1.5 mm. long attached to its base.

*Type-locality*.— $53^{\circ} 12' N.$ ,  $171^{\circ} 37' W.$ , 43.5 miles north-west of west point of Yunaska Island, Aleutian Islands, 1217 fathoms, fine black sand; bottom temperature  $35.2^{\circ}$  Fahr. (U.S. Fisheries steamer 'Albatross,' 1906).

*Zoroaster evermanni mordax*, subsp. n.

Closely resembling *Z. evermanni*\*, but differing in having more robust primary spines (which are typically also a little shorter actinolaterally), and in having on the second from inner spine of prominent adambulacral plates a large pedicellaria (or sometimes two), from 1.5 to 2.5 mm. long, and conspicuously bigger than the cluster of small pedicellariæ on the furrow-spine.  $R=153$  mm.,  $r=10+$  mm.,  $R=15r$ .

*Type-locality*.—Off Washington,  $47^{\circ} 28' N.$ ,  $125^{\circ} 15' W.$ , 477 fathoms, green mud.

This race is distributed from off Washington to southern California. At the southern end of its range it is found only in water deeper than 600 fathoms, while the typical *evermanni* occurs from San Diego, California, to Santa Cruz Island, California, in 216 to 510 fathoms.

*Key to the North Pacific Species and Subspecies of  
Myxoderma.*

a. Size large ( $R, 200$  mm.). The plates and spines invested in a thick pulpy membrane, slimy in life; abactinal papular areas large, the dorsal skeleton being open and rather irregularly reticulate at base of ray; abactinal plates without accessory spinelets to any extent; actinolateral spines pointed, tapered, sometimes somewhat flattened, but never spatulate; terminal plate large, ovoid, especially conspicuous in young specimens; rays attenuate distally.

b. Rays thicker and skeleton stouter, third or lowest series of actinolateral plates extending five-eighths the length of ray; abactinal spines robust and stubby;

\* *Zoroaster evermanni*, Fisher, Bull. Bureau Fisheries, 1904, vol. xxiv., June 10, 1905, p. 317. Further investigation has shown that this is not a *Myxoderma*, as it lacks the essential anatomical characters of that genus.



- abactinal pedicellariæ smaller and less numerous. Bering Sea to central California ..... *sacculatum* (Fisher).
- ♂<sup>2</sup>. Rays longer and slenderer, the third or lowest actinolateral series of plates extending along only the proximal third of the ray; spines rather slenderer, and abactinal pedicellariæ larger and more numerous. California, south of Point Conception ..... *ectenes*, subsp. n.
- α<sup>2</sup>. Size medium, the plates and spines not especially sacculate or slimy—about as in *Zoroaster*; abactinal papular areas medium in size, the areas with one or two papulæ which do not occupy all the area; adradial plates small, more or less overlapped by the carinals and superomarginals; abactinal plates with numerous, accessory, military spinelets; actinolateral spines broad, flat, and more or less truncate; terminal plate small; rays not attenuate distally.
- ♂<sup>4</sup>. Rays slenderer and longer, disk smaller; plates, especially the carinal and marginal, not broader than long; superomarginals not noticeably prominent; spines slenderer; pedicellariæ larger. Southern California (south of Point Conception) and Lower California ..... *platyacanthum* (Clark).
- ♂<sup>5</sup>. Rays broader and shorter, disk slightly larger; plates, especially the carinal and marginal, broader than long; superomarginals noticeably prominent, at least distally; spines more robust; pedicellariæ shorter. Oregon to Central California ..... *rhomaleum*, subsp. n.

★

*Myxoderma sacculatum ectenes*, subsp. n.

Differing from typical *M. sacculatum*\* (Fisher) in having slenderer and longer rays, the third or lowest actinolateral series of plates present on only a small proximal portion (about a third) of each ray, rather slenderer abactinal spines generally, and larger and more numerous abactinal pedicellariæ. R=210 mm., r=16 mm., R=13r; breadth of ray at base 19 mm.

*Type-locality*.—South-west of Santa Cruz Island, California, 640 fathoms.

This race is found off southern California, from the vicinity of Santa Cruz Island to Los Coronados Islands, and from about 500 to 1100 fathoms, usually on green mud.

\* *Zoroaster (Myxoderma) sacculatus*, Fisher, *ibid.* p. 316.

*Myxoderma platyacanthum rhomaleum*, subsp. n.

Differing from *M. platyacanthum*\* (Clark) in having constantly broader and slightly shorter rays, slightly larger disk, much heavier abactinal and marginal spines, slightly shorter and decidedly heavier actinolateral spines, and shorter abactinal pedicellariæ.  $R=100$  mm.,  $r=12.5$  mm.,  $R=8r$ , breadth of ray at base 13 mm.; at a little beyond base 15.5 mm. Disk elevated, dome-shaped, rays very gradually tapered, but not attenuate distally.

*Type-locality*.—Off Oregon ( $43^{\circ} 46' N.$ ,  $124^{\circ} 57' W.$ ), 277 fathoms, grey sand; bottom temperature  $42.2^{\circ}$  Fahr.

Known from off Oregon and Central California, 277 to 296 fathoms, grey sand;  $41.8^{\circ}$  to  $42.2^{\circ}$  Fahr.

XXXVII.—*Notes on Fossorial Hymenoptera*.—XXXVII. On some Sphecinae in the British Museum. By ROWLAND E. TURNER, F.Z.S., F.E.S.

Genus SCELIPHRON.

*Sceliphron masaicum*, sp. n.

♀. Nigra, nigro-pilosa; petiolo, tertio apicali nigro, trochanteribus posticis, femoribus posticis dimidio basali, tibiis posticis tertio basali, metatarso postico basi nigro, tarsisque posticis articulo secundo flavis; alis subhyalinis, flavo leviter suffusis, venis nigris, alis anticis apice angustissimo infumatis.  
Long. 20–21 mm.

♀. Clypeus very distinctly bilobed at the apex, closely punctured and clothed with long black hairs, which also extend over the whole head and thorax; on each side of the bilobed central portion of the apical margin is a small tooth; mandibles bidentate at the apex, the outer tooth the longest. Eyes distinctly nearer to each other on the vertex than on the clypeus; second joint of the flagellum a little longer than the first and third combined. Pronotum deeply longitudinally grooved in the middle, finely punctured; mesonotum rugulose, scutellum and postscutellum closely longitudinally striated. Median segment with a deep and broad

\* *Zoroaster platyacanthus*, H. L. Clark, Bull. Amer. Mus. Nat. Hist. vol. xxxii, July 9, 1913, p. 199, pl. xlv. figs. 1 & 2.

longitudinal median groove, the dorsal surface rather finely obliquely striated; the oblique posterior slope finely transversely striated, with a deep median groove; the sides of the segment closely vertically striated. Petiole not quite as long as hind coxa, trochanter, and femur combined. Tarsal ungues with a small median tooth, the pulvillus large. Second abscissa of the radius at least as long as the first and third combined; first recurrent nervure received close to the middle of the second cubital cell, second at about one-eighth from the apex of the same cell.

*Hab.* British East Africa, Ngare Narok, Masai Reserve, 6000 ft. (*A. O. Luckman*), December 31, 1913, 6 ♀♀; Mogorri River (*A. O. Luckman*); Nandi Plateau, 5700-6200 ft. (*S. A. Neave*), May 30-June 4, 1911; Uganda, Tero Forest (*S. A. Neave*), Sept. 26-30, 1911.

This is a larger species than *S. quartina*, Grib., with differently coloured pubescence and fore legs; the apical third, or in some specimens half, of the petiole is black; it is a smaller species than *S. spirifex*, Linn., differing also in the colour of the legs, petiole, and wings, and in the much greater length of the second abscissa of the radius.

*Sceliphron eckloni*, Dahlb.

*Pelopaeus eckloni*, Dahlb. Hymen. Eur. i. p. 434 (1845).

*Pelopaeus clypeatus*, Fairmaire, Arch. Entom. ii. p. 264 (1858).

Probably identical with *S. spinola*, Lep., as suggested by Gribodo, but I have not seen Indian specimens.

Genus SPHEX (*Ammophila*, auct.).

*Sphex tenuis*, Pal. Beauv.

*Sphex tenuis*, Pal. Beauv. Insect. rec. en Afriq. & Amer. p. 43, Hymén. (1837). ♂.

*Ammophila guineensis*, Ritsema, Tijdschr. v. Entom. xvii. p. 192 (1874). ♀.

*Ammophila maculifrons*, Cam. Ann. Transvaal Mus. ii. p. 134 (1910). ♀.

*Ammophila caeruleornata*, Cam. Ann. Transvaal Mus. ii. p. 135 (1910). ♂.

*Sphex beniniensis*, Pal. Beauv.

*Sphex Beniniensis*, Pal. Beauv. Insect. rec. en Afriq. & Amer. p. 43, Hymén. (1837). ♂.

*Ammophila cyaniventris*, Guér. Mag. de Zool. xiii. P. 114, p. 9 (1843). ♂.

*Ammophila* (*Parapsammophila*) *lugubris*, Gerst. Monatsber. Akad. Wiss. Berlin, p. 510 (1857). ♀ ♂.

*Ammophila lugubris*, Gerstaecker, Peters, Reise u. Mossambiquis, Zool. v. p. 480 (1862).

*Sphex braunsi*, sp. n.

♀. Nigra; mandibulis, apice excepto, tergitis sternitisque primo secundoque, tertio basi extrema, femoribus anticis subtus, intermedii dimidio apicali, supra nigro-lineatis, tibiis anticis intermedisque, tarsisque anticis ferrugineis; petiolo segmento primo nigro; tegulis testaceis; alis subhyalinis, apice leviter infumatis, venis nigris; pronoto mesonotoque transverse striatis.

♂. Feminae similis; mandibulis tarsisque anticis nigris.

Long., ♀ 18, ♂ 16 mm.

♀. Mandibles with a long acute apical tooth and two strong teeth on the inner margin. Clypeus with sparse large punctures, microscopically punctured and pubescent; head subopaque, with sparse large punctures, a deep groove from the anterior ocellus to the base of the antennæ. Eyes almost parallel on their inner margins; posterior ocelli much further from the eyes than from each other, separated from the eyes by a distance about one-third greater than the length of the third joint of the flagellum. Pronotum a little longer than the scutellum, nearly twice as broad anteriorly as long, with a deep median groove on the posterior half, rather strongly transversely striated. Mesonotum strongly transversely striated, with a deep median sulcus reaching almost to the posterior margin, where the striæ are oblique. Scutellum and postscutellum longitudinally striated. Median segment rugose, with oblique striæ, which are more distinct laterally than in the middle. First joint of the petiole black, almost exactly equal in length to the hind femur, a little longer than the second joint of the petiole; second tergite longer than its apical breadth. Tarsal unguis simple, with a distinct pulvillus. Pleuræ rugose, with more or less distinct oblique striæ, evenly covered with very delicate whitish pubescence. Spiracle of the first tergite situated considerably behind the middle.

♂. One large tooth only on the inner margin of the mandibles; eyes converging towards the clypeus; apical margin of the clypeus widely and shallowly emarginate; eighth sternite rather narrowly rounded at the apex. Third cubital cell in both sexes small, contracted both on the radius and cubitus, second abscissa of the radius longer than the first in the female, a little shorter in the male, more than twice as long as the third.

*Hab.* Willowmore, S. Africa (*Dr. Brauns*), October 1, 1916.

The pronotum is much longer than in the common *S. tenuis*,

Pal. Beauv., and the colouring is also very different. The male genitalia are also different, the stipes being narrower and more acute at the apex than in *tenuis*. The pulvillus is absent in *tenuis*.

*Sphex dolichoderus*, Kohl.

*Ammophila dolichodera*, Kohl, Verh. zool.-bot. Ges. Wien, xxxiii. p. 353 (1883). ♂.

*Ammophila pulchricollis*, Cam. Ann. Transvaal Mus. ii. p. 133 (1910). ♂.

According to Dr. Brauns, Cameron's type is a female. Kohl, in his table a few pages before the description of *dolichodera*, gives the name of the species as *macrocha*. Probably he originally intended to use this name and changed it in the description, but neglected to make the alteration in the table.

*Sphex ferrugineipes*, Lep.

*Ammophila ferrugineipes*, Lep. Hist. nat. Insect. Hymen. iii. p. 383 (1845). ♀.

*Ammophila dunbrodyensis*, Cam. Rec. Albany Mus. i. p. 322 (1905).

*Sphex basalis*, Sm.

*Ammophila basalis*, Sm. Cat. Hym. B.M. iv. p. 214 (1856). ♀.

*Ammophila nigripes*, Sm. Cat. Hym. B.M. iv. p. 215 (1856). ♂.

*Sphex (Coloptera) tuberculiscutis*, sp. n.

♀. Nigra; mandibulis, apice excepto, clypeo, antennis articulis sex basalibus, prothorace, mesonoto lateribus, mesopleuris macula sub alis, tegulis, scutello, postscutello, tergito secundo leviter nigro suffuso, petiolo subtus, sternitis pedibusque, femoribus supra nigrolineatis, ferrugineis; alis sordide hyalinis, flavo-auffusis, venis nigris; pronoto fere polito, antice subexcavato, utrinque tuberculato, postice in medio obsolete transverse striato, mesonoto transverse striato; scutello postscutelloque longitudinaliter striatis, postice productis, lamellato-tuberculatis.

♂. Feminae similis, tergito secundo nigro, basi fusco-ferrugineo; clypeo apice in tuberculo producto.

Long., ♀ 21-22, ♂ 22-25 mm.

♀. Mandibles with one large, broad, blunt tooth on the inner margin, clypeus broadly subtruncate at the apex. Eyes almost parallel on the inner margins; posterior ocelli almost as far from each other as from the eyes; front not concave, without a distinct longitudinal sulcus; the face and sides of the clypeus clothed with very delicate pale golden

pubescence. Propleuræ almost smooth; mesopleuræ rather sparsely punctured; sides of the median segment coarsely rugulose, dorsal surface of the segment rugose; the humeral calli, the apex of the median segment, and a long band on the hind margin of the mesopleuræ clothed with very delicate shining silver pubescence. First joint of the petiole about as long as the hind femur and trochanter combined; second tergite slender, half as long again as its apical breadth. Pulvillus well developed. Second abscissa of the radius about half as long as the first.

♂. Eyes very slightly convergent towards the clypeus; posterior ocelli a little nearer to the eyes than to each other. Clypeus produced into a porrect tubercle in the middle of the anterior margin. Transverse strigæ of the pronotum more developed than in the female. First joint of petiole distinctly longer than the hind femur and trochanter combined; eighth sternite broadly truncate at the apex.

*Hab.* British East Africa, Masongaleni, 3000 ft. (*S. A. Neave*), March 29–April 1; Kibwezi, 3000 ft. (*S. A. Neave*), April 2–4; Mitto Andei, 2500 ft. (*S. A. Neave*), March 26–28; Tiwa River, Ukamba (*S. W. J. Scholefield*), January 22–27.

Nearly allied to *saussurei*, Buyss., but easily distinguished by the curious form of the pronotum and by the more strongly produced scutellum and postscutellum. The male clypeus differs strongly from that of the Palearctic species *barbara*, Lep., and *judeorum*, Kohl.

#### Genus CHLORION.

*Chlorion (Isodontia) apicata*, Bingh.

*Anmophila apicata*, Bingh. Fauna Brit. India, Hymen. i. p. 234 (1897). ♀.

*Chlorion (Isodontia) praslinius*, Guér.

*Sphex praslinius*, Guér. Voy. Coq., Zool. ii. p. 262 (1839).

*Sphex morosa*, Sm. Journ. Proc. Linn. Soc., Zool. iv., Suppl. p. 122 (1860).

*Chlorion (Proterosphex) paulinieri*, Guér.

*Sphex Paulinieri*, Guér. Magas. de Zool. xiii. P. 114, p. 8 (1843). ♀.

*Sphex eximia*, Lep. Hist. nat. Insect. Hymén. iii. p. 360 (1845). ♂.

This belongs to the group of *aurulentus*, Fabr., with the median segment transversely striated. Kohl wrongly treats the species as a true *Chlorion* in the most restricted sense, but had not seen a specimen.

XXXVIII.—*New Australian Diplopterous Hymenoptera.*  
By ROWLAND E. TURNER, F.Z.S., F.E.S.

*Paralastor aterrimus*, sp. n.

♂. Niger; clypeo apice anguste, fronte interantennali, scapoque subtus flavis; tarsi fusco-brunneis; alis hyalinis, anticis, præcipue area costali, infuscatis; venis nigris; clypeo apice subtruncato; sternito secundo basi elevato-tuberculato.

Long. 10 mm.

♂. Clypeus closely microscopically punctured, with larger scattered punctures, with very delicate close-lying pubescence at the base, the apex subtruncate, scarcely emarginate. Front coarsely and rather closely punctured, vertex coarsely punctured-rugose. Thorax and median segment coarsely punctured-rugose; tegulæ very coarsely punctured. First tergite very coarsely punctured, second much more finely and sparsely punctured; the apical margins of tergites 3-6 narrowly fuscous brown. Second sternite shining, rather strongly, but not very closely punctured, raised and sub-tuberculate at the base. The first abdominal segment is broad. Antennæ, as in all males of the genus, with only eight well-developed joints, the joints beyond the eighth minute and concealed.

*Hab.* Townsville, Queensland (*Dodd*).

*Paralastor diabolicus*, sp. n.

♂. Niger; clypeo apice late maculaque magna basali, fronte interantennali scapoque subtus flavis; tarsi articulo apicali luteo; alis hyalinis, anticis dimidio costali fortiter infuscatis, venis nigris; clypeo apice late emarginato; sternito secundo basi fortiter elevato-tuberculato.

Long. 11 mm.

♂. Clypeus closely microscopically punctured, with sparse larger punctures intermingled, the apex widely, but not very deeply emarginate. Head coarsely punctured, rather more sparsely on the front than on the vertex; a low arched carina above the anterior ocellus. Thorax and tegulæ very coarsely punctured; median segment punctured-rugose. First tergite broad, very coarsely punctured; second much more finely punctured, shining between the punctures; second sternite very strongly raised and bluntly

tuberculate at the base. The apical sternites from the third are dull ferruginous brown.

*Hab.* Townsville, Queensland (*Dodd*).

Extremely like *aterrimus*, but differs in the broader and emarginate clypeus, in the yellow base of the clypeus, in the colour of the apical sternites, and in the more strongly raised and tuberculate base of the second sternite. Both species are very different in colour from other species of the genus, superficially resembling *Odynerus dietrichianus*, Sauss., and other similarly coloured *Odynerus*. In both species the clypeus is feebly convex, somewhat more strongly in *aterrimus* than in *diabolicus*. The two species appear to be closely allied, much more so than is usually the case in species with the same colour-pattern found in the same locality.

*Paralastor submersus*, sp. n.

♀. Nigra; macula parva interantennali, tergitoque secunda macula maxima utrinque in medio confluentibus, flavis; alis infuscatis, venis nigris.

Long. 11 mm.

♀. Clypeus strongly and rather sparsely punctured, flat, widely and rather shallowly emarginate at the apex, the apical margin distinctly raised. Head coarsely and closely punctured, thorax punctured-rugose, tegulae sparsely punctured at the base, more closely towards the apex. Median segment punctured-rugose; first tergite strongly punctured, the punctures becoming sparse and smaller towards the apex; second tergite much more finely and sparsely punctured, the punctures becoming much closer and rather larger at the apex. Second sternite strongly punctured, raised and subtuberculate at the base.

*Hab.* Lolworth Station, N. Queensland; June 29, 1901. Received from Mr. Froggatt. 1 ♀.

Superficially this somewhat resembles *P. conspiciendus*, Perkins, but the form of the clypeus shows that it is really allied to the group of *P. mackayensis*, Perkins, and *P. carinatus*, Sm. The vessel on which the box containing the specimen was sent was torpedoed, and the box was submerged, but after treatment the specimen was dried in a fairly satisfactory manner.

In all species described here the length measurement is to the apex of the second abdominal segment. The types are in the British Museum.



XXXIX.—*Remarks on the Age of some Arctic and North-Atlantic Starfishes.* By JAMES A. GRIEG, Curator of the Bergen Museum, Bergen, Norway.

DR. MORTENSEN has shown, in "Smaa faunistiske og biologiske Meddelelser"\*, that ophiurids of various ages are found simultaneously in shallow water at the same locality within the boreal region; transformed young were collected recently, together with one-year old, fully developed two-year old, and older individuals. At Sallingsund Dr. Mortensen obtained young of *Ophiura ciliaris* with a disc-diameter of  $4\frac{1}{2}$  mm., one-year old individuals with a disc-diameter of 3-4 mm., two-year old ones with a disc-diameter of 7-11 mm., and several whose disc-diameter was more than 12 mm. and whose age was probably three years.

The circumstances are the same on the Norwegian southern and western coasts; on the other hand, Dr. Mortensen in "Echinoderms from East Greenland"† mentions that a large number of *Ophiura sarsi* obtained off Jan Mayen were all of about the same size (disc-diameter 15-20 mm.). As numerous specimens of *Ophiura robusta*, a very small species, were taken in the same haul, the small *Ophiura sarsi* could not have been overlooked. At Jan Mayen there could only have lived a single year-class of *Ophiura sarsi*, whose age Dr. Mortensen estimates at one year, though I am most inclined to estimate it at three years.

An examination of the ophiurids collected by the 'Michael Sars' in the Norwegian Sea shows that very often a single year-class occurs at a locality, exactly as stated by Dr. Mortensen in regard to Jan Mayen; but several year-classes may also be found—in this case, one of them is generally more numerously represented than the others‡.

In this paper I shall confine my remarks to a haul which the 'Michael Sars' made in the summer of 1914 off the mouth of the Varanger Fjord. From this haul 157 *Ophiura sarsi* were obtained with a disc-diameter of 16-27 mm., and one specimen measuring 11 mm.; of these no fewer than 99 (or 63 per cent.) have a disc-diameter of 22-24 mm.—this large group represents a year-class whose age must be put at four years. There were also several individuals—not very

\* Vidensk. Meddel. 1897, p. 821.

† Meddel. om Grönland, xxix. 1903, p. 82.

‡ 'Bergens Museums Aarbok,' 1903, no. 13, p. 23.

distinct, however—with a disc-diameter of 16–19 mm., which must correspond to Dr. Mortensen's of 15–20 mm. from Jan Mayen; the majority in this group cannot be more than three years old. Finally, there is the specimen of 11 mm., the age of which must be estimated at two years.

The ophiurids from the great depths of the North Atlantic collected by the 'Michael Sars' in 1910 show that the same conditions exist as in the Norwegian Sea. A species of ophiurids may be represented at a locality by several year-classes, but only one of them numerously.

During the examination of the echinoderms collected by the 'Michael Sars' in 1910, I also commenced work on the starfishes to see whether the conditions were the same as in the ophiurids. In order to have material as abundant as possible I did not confine my attention to that taken in 1910, but added some from other cruises of the 'Michael Sars' and similar expeditions. Altogether I examined 14 species, which were collected in Arctic waters, off the Norwegian coasts, and in the North Atlantic. I had abundant material of some species: thus of about 500 specimens of *Pontaster tenuispinus* 155 were from one locality, and of about 800 specimens of *Ctenodiscus crispatus* 355 were from one locality; of the remaining species the material was somewhat scanty—it is, however, of importance for the purpose of comparison. The result of these investigations is more fully discussed in "Nogen asteriders alder og aarsklasser" \*; as this paper is written in Norwegian, I here give an abstract from it.

The diameter of the disc served to determine the annual classes of the ophiurids, but in the starfishes it was more convenient to use the radius of the disc.

The measuring method requires many examples, and even then the age of a specimen can only be determined with certainty if its size comes within the measurements of the majority of the individuals of a year-class. Another drawback to this method is that the conditions of life and, consequently, growth may differ at different localities; the results from one locality can therefore not be applied unconditionally to another. Following the usual practice when studying fishes, I have examined the marginal plates of the starfishes and other parts of their skeleton in order to arrive at the age of each individual, but I have not definitely succeeded in finding annual rings. I have therefore been obliged to fall back upon the measuring method.

\* 'Bergens Museums Aarbok,' 1916–17, Naturvidensk Række, no. 1.

Radius of disc in millimetres.	<i>Pontaster tenuispinus.</i>				<i>Otenodiscus crispatus.</i>			<i>Hymenaster pellucidus.</i>	<i>Dactylophaster robustus.</i>	<i>Plutonaster bifrons.</i>	<i>Benthopecten sphenosus.</i>	<i>Dyalaster agassizi.</i>
	Mouth of Sogne Fjord.	Coast of Romsdal.	Fro Island.	Kara Sea.	Parent's Sea.	E. off Iceland.	S.W. off Ireland.					
1	...	...	1	1	1	1	...	...	...	...	1	...
2	...	...	6	11	1	...	...	...	...	...	...	...
3	1	...	13	19	1	...	...	...	...	...	...	...
4	...	...	9	20	4	...	...	...	...	...	...	...
5	1	...	4	10	1	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...	...	...	...	...
7	16	18	...	1	...	...	...	...	...	...	...	...
8	33	15	...	...	23	...	...	...	...	...	...	...
9	48	12	1	...	34	...	...	...	...	...	...	...
10	33	2	...	3	38	...	...	...	...	...	...	...
11	8	1	...	...	39	...	...	...	...	...	...	...
12	4	...	...	...	41	...	...	...	...	...	...	...
13	...	...	...	...	29	...	...	...	...	...	...	...
14	...	...	...	...	6	...	...	...	...	...	...	...
15	...	...	...	...	1	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...
17	...	...	...	...	...	...	...	...	...	...	...	...
18	...	...	...	...	...	...	...	...	...	...	...	...
19	...	...	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...	...	...
21	...	...	...	...	...	...	...	...	...	...	...	...
22	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...	...	...
153	...	52	34	55	100	140	215	20	25	27	12	34

Originally my intention was only to settle whether one or several year-classes of a species of starfishes occur at a locality, and, if several, whether one of these is more numerous than the others. In the course of my investigations it appeared that a similar number of annual classes is gathered at the same locality of more than one species. In *Pontaster tenuispinus* we find an annual class with a disc-radius of 3-4 mm., another of 8-10 mm. We find the same number of *Ctenodiscus crispatus*, *Psilaster andromeda*, etc., or else the numbers are very close to those mentioned for *Pontaster tenuispinus*. Therefore, if we could determine the age of a year-class for one species, that of the others would also be known. Among some echinoderms from Utnøe, Hardanger, I was fortunate enough to find some very small *Psilaster andromeda*, which had apparently been recently transformed to the bottom stage. This was consequently group 0, other material belonged to group I., etc.

The measurements mentioned in this paper are given in the table on p. 402, the remainder appear in "Nogen asterideres alder og aarsklasser."

I shall first endeavour to show that starfishes occurring at a locality are, as a rule, represented by several year-classes, but only one of them numerous. The 'Voeringen' took 153 *Pontaster tenuispinus* off the mouth of the Sogne Fjord: of these one specimen had a disc-radius of 3 mm., the rest measured 5-12 mm., with a maximum of 119 specimens (or 76.8 per cent. of the total number) at 8-10 mm. A year-class is evidently gathered about these measurements. The 3 mm. specimen belongs to another year-class, as is clearly shown by 34 specimens taken by the 'Voeringen' off the Fro Islands; of these one specimen had a disc-radius of 9 mm., the rest 1-5 mm., including 12 specimens at 3 mm. The conditions in the two localities were therefore quite different: off the Fro Islands there was a maximum of 12 specimens at 3 mm. and one only at 9 mm.; the Sogne Fjord locality had, on the contrary, a maximum of 48 specimens at 9 mm., but one only at 3 mm. Common to both localities is the circumstance that two year-classes were represented, only one of them numerous.

At a station off the coast of Romsdal the 'Voeringen' took 52 *Pontaster tenuispinus*, which had a disc-radius of 6-11 mm., with a maximum of 45 specimens at 7-9 mm. Evidently only one annual class was represented here, and that one must have been of the same age as the large group from the station off the Sogne Fjord. As stated above, there was at

this locality a maximum at 8-10 mm., while at the station off the coast of Romsdal it was at 7-9 mm. The difference must be attributed to the fact that there were better conditions of life at the one locality than at the other.

Quite the same result that the Fro Islands material gives is exhibited by 55 specimens from a locality in the Kara Sea. As the table shows there is a marked maximum of 49 specimens at 3-5 mm., while only 5 specimens have a disc-radius of 7-10 mm. From another locality in the Kara Sea there are 37 specimens, which show that three year-classes may be represented at a locality, but only one of them numerous. We have first a large group of 29 specimens which have a disc-radius of 2-7 mm., with a maximum of 22 specimens at 3-5 mm. Then, a group of 7 specimens with a disc-radius of 9-13 mm., and, finally, one specimen of 23 mm. Each of these groups must represent an annual class, the youngest of which only was numerous.

The material of *Pontaster tenuispinus* examined by me shows that this species has a year-class at 3-4 mm., another at 8-10 mm., and I have had some specimens with a disc-radius of more than 13 mm. The material of this last group is unfortunately so sparing that it has not been possible to determine where its maximum is to be found; I should be inclined to think that it must be looked for at about a radius of 15 mm. With a disc-radius of 23 mm. *Pontaster tenuispinus* has attained its maximum of growth. Whether it is possible to find one or two year-classes between 13 mm. and 23 mm. cannot at present be definitely determined, but I am most inclined to think that representatives of two year-classes are to be found between these two sizes.

From three localities in the Barent's Sea I have measured 169,\*149, and 335 specimens respectively of *Ctenodiscus crispatus*. The specimens from the first locality measured 3-13 mm. and had a maximum of 128 specimens (or 77.7 per cent. of the total number) at 7-10 mm.; at the second locality there was a maximum of 132 specimens (or 88.6 per cent.) at 8-11 mm.—these specimens measured 6-13 mm.; at the third locality the specimens measured 6-16 mm.—at 9-12 mm. there was a maximum of 267 specimens (or 79.7 per cent. of the total number). If we compare the material, we find that the majority of the specimens at all three localities are of the same size and represent the same annual class. It is very probable, however, that at two of the localities, at least, there were specimens of still another year-class, for material from other localities indicates that the smallest specimens from the

first locality and the largest from the last-named one must be of an age other than the rest.

I stated above that the examples of *Pontaster tenuispinus* examined represent three or possibly four annual classes. The material of *Ctenodiscus crispatus* is only composed of three year-classes: the maximum of the youngest class is at 4-5 mm., that of the second at about 10 mm., and that of the third at 15-16 mm. A fourth year-class seems to be out of the question in the case of this species, as it has already attained its maximum growth at 18-19 mm.

It has been mentioned already that the food-conditions and therefore the conditions of growth may be different in different localities. The maximum of a year-class will be gathered about a measurement which varies somewhat for different localities. In speaking of *Pontaster tenuispinus* I have called attention to this fact, which is still more striking when we compare the material of *Ctenodiscus crispatus* mentioned above. As will be shown below, the two-year old annual class has its maximum at a disc-radius of 7-10 mm. at one locality, at 8-11 mm. at another, and at 9-12 mm. at a third, which has evidently offered the best conditions of life. I ought to mention that the material from all localities was collected in June, though in different years.

As it is with these two species, so it is with others that live at shallower depths in Arctic and boreal waters. The conditions are the same at the great depths in the Norwegian Sea and the North Atlantic. The 'Michael Sars' took 26 *Hymenaster pellucidus* in 1900 in the cold area off the east coast of Iceland with a disc-radius of 4-25 mm. This material affords a maximum of 9 specimens at 8-9 mm., fewer at 14-15 mm., and still fewer at 22 mm.; there were thus three year-classes from this locality. Other material indicates that the 4 mm. specimens represented a fourth annual class.

Another species characteristic of the cold area of the Norwegian Sea is *Bathybiaster vexillifer*, which may also be represented by several year-classes at a locality. It may be mentioned that the juvenile specimens of *Bathybiaster vexillifer*, described by Danielssen and Koren under the name *Hyster mirabilis*, was taken together with two full-grown ones. The 'Michael Sars' found in 1902 at a locality in the cold area north of the Faroe Islands a very young specimen whose disc-radius measured 4 mm., another of 7 mm., and still others of as much as 22 mm.; some of these were thus among the largest known in this species. In other words,

there have been living at least three year-classes at the same locality. In the cold area off "Tampen" the 'Armauer Hansen' in 1914 took three *Bathybiaster vexillifer* whose disc-radius measured 2.7, 3.5, and 25 mm. respectively; here were therefore two quite young individuals which must represent one annual class and a full-grown individual belonging to quite another.

In the North Atlantic the genus *Bathybiaster* is represented by *Bathybiaster robustus*, a species which shows so much likeness to *Bathybiaster vexillifer* that Verrill\* considered it as probably identical. A closer examination, however, shows that they are two different species, each living within its own territory—the one within the cold area of the Norwegian Sea, the other in the warm area of the North Atlantic. They also differ from one another in the structure of the skeleton. There is the same difference between them that there is between *Pecten frigidus* of the Norwegian Sea and *Pecten biskayensis* of the North Atlantic. S.W. of Ireland the 'Michael Sars' obtained 25 specimens of *Bathybiaster robustus*, which are grouped as follows: two specimens measured 11–12 mm., the rest 15–21 mm., with a maximum of 11 specimens at 19–20 mm. That the maximum is found among the largest specimens seems to indicate that the smallest (11–12 mm.) specimens must belong to another annual class.

In the eastern part of the North Atlantic *Plutonaster bifrons* is the most commonly distributed starfish. It is known from numerous localities between Faroe-Shetland Channel and the Cape Verde Islands. In 1910 the 'Michael Sars' collected this species at no fewer than seven localities, at some of them in great numbers—thus at a station W. of the Hebrides as many as 87 specimens were found. This material has a disc-radius of 8–21 mm., besides which there is a specimen of 24 mm. There are two marked maxima, one at 10–11 mm. comprising 28 specimens (or 32.2 per cent. of the total number) and another at 17–18 mm. with 17 specimens (or 19.5 per cent. of the total number). Both these maxima must represent annual classes. Judging from material from another locality the 24 mm. specimen must belong to yet another year-class.

The examples given must suffice. It appears from all the material examined that starfishes living at a given locality may belong to one year-class; but most frequently they

\* Proc. U.S. Nat. Museum, xvii. 1894, p. 256.

represent two or more, only one of them being numerous. The material also shows that each year-class is grouped about certain definite sizes, and that these as a whole are common to all species examined. *Pontaster tenuispinus* has a year-class whose maximum is gathered about a disc-radius of 3-4 mm.; *Ctenodiscus crispatus*, *Leptychaster arcticus*, *Bathybiaster vexillifer*, *Solaster papposus*, *Hymenaster pellucidus*, *Henricia sanguinolenta*, etc., have likewise a year-class of this size; *Pontaster tenuispinus* has the next year-class at 8-10 mm. In like manner we find that *Plutonaster bifrons*, *Pytaster agassizi*, *Ctenodiscus crispatus*, *Hymenaster pellucidus*, etc., have a year-class at the same size. It should be noted that the figures are not absolutely exact; with respect to some species and localities they may be found a little above or a little below those given, as I have already stated. Speaking generally, these are agreements which cannot be due to accidental circumstances. Each of these year-classes must have a fixed age, and if the year-class 3-4 mm. of *Pontaster tenuispinus* is one year old, then that year-class of the other species which is of the same size must also be one year old. It was therefore important to fix the age of a year-class in a species, as thereby the age was given for the other species.

I was fortunate to determine the age of some of the specimens of *Psilaster andromeda*, collected by Dr. D. C. Danielssen at Utne, Hardanger. The smallest specimens from Utne have a disc-radius of 0.5 mm. They were young which had recently been transformed to the bottom stage, and thus belong to group 0. Of the rest two specimens measured 3 mm., three 7-8 mm., four 10-12 mm., and two 14-15 mm. By comparing this material with some from other localities it appeared that the next year-class, which is one year old (group I.), is gathered about a disc-radius of 3-4 mm. Two-year old individuals (group II.) have a disc-radius of 7-8 mm., three-year old ones (group III.) 12-15 mm., and four-year old ones (group IV.) 18-20 mm. *Psilaster andromeda* has attained its maximum of growth at a disc-radius of 20-22 mm. It should not therefore attain a greater age than four years. The same also holds good for *Pontaster tenuispinus*, *Plutonaster bifrons*, *Bathybiaster vexillifer*, and probably most of the Northern starfishes.

Among the species whose age I have determined, *Ctenodiscus crispatus* and *Hymenaster pellucidus* differ from the above; the former seems only to attain three years and the latter five or possibly six years.



Several species, among them our most common starfish (*Asterias rubens*), I have been unable to examine. The material of some of the species was rather scanty and was from a single locality only. This was the case with *Benthopecten spinosus* and *Dytaster agassizi*. The specimens examined of these two species (see the table, p. 402) have a disc-radius of 5-10 mm. and 6-12 mm. respectively\*, and seem to belong to the same year-class (group II.). The question regarding the age of the starfishes therefore needs further investigation.

XL.—*Synopsis of the American Species of Rana.*

By G. A. BOULENGER, F.R.S.

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I. Toes pointed or with slightly swollen tips.

- A. Glandular dorso-lateral fold absent or flat and ill-defined, or, if narrow and prominent, not extending to the hip; tympanum at least  $\frac{3}{4}$  diameter of eye, usually much larger, especially in males; tibia  $2\frac{1}{2}$  to 4 times as long as broad; toes  $\frac{3}{4}$  to entirely webbed; outer metatarsals separated by web nearly to the base; nasal bones in contact with each other or narrowly separated.

1. Male with internal vocal sacs; dorso-lateral fold absent or flat and very indistinct.

Vomerine teeth between the choanæ (rarely just behind them); first finger as long as or a little longer than second; tibio-tarsal articulation reaching tympanum or eye; heels meeting or slightly overlapping when the hind limbs are folded at right angles to the body; tibia  $2\frac{1}{2}$  to  $2\frac{3}{4}$  times in length from snout to vent; tip of fourth toe free; no dorso-lateral fold .....

*R. catesbiana*, Shaw.

Vomerine teeth between the choanæ; first finger a little shorter than second; tibio-tarsal articulation reaching tympanum

\* The material of *Benthopecten spinosus* has not a maximum; of *Dytaster agassizi*, on the other hand, there is a marked maximum at 9-10 mm. comprising 18 individuals (or 52·9 per cent. of the total number).

- or eye; heels meeting or narrowly separated; tibia  $2\frac{1}{2}$  to  $2\frac{3}{4}$  times in length from snout to vent; web extending to tip of fourth toe; no dorso-lateral fold. *R. gryllis*, Stejn.
- Vomerine teeth on a level with posterior borders of choanae, or just behind them; first and second fingers equal; tibio-tarsal articulation reaching eye; heels meeting or slightly overlapping; tibia 2 to  $2\frac{1}{2}$  times in length from snout to vent; one or two phalanges of fourth toe free; dorso-lateral fold present or absent ..... *R. septentrionalis*, Baird.
2. Male with internal vocal sacs; dorso-lateral fold usually very distinct; vomerine teeth between choanae or just behind them; first finger as long as or a little longer than second; tibio-tarsal articulation reaching eye or between eye and tip of snout; heels overlapping; tibia  $1\frac{1}{2}$  to  $2\frac{1}{2}$  times in length from snout to vent; one or two phalanges of fourth toe free.
- Dorso-lateral fold not extending beyond sacral region ..... *R. clamitans*, Daud.
- Dorso-lateral fold extending beyond sacral region ..... *R. onca*, Cope.
3. Male with external vocal sacs; tympanum not larger than eye; first finger as long as or slightly longer than second; heels meeting or not.
- Head as long as broad; tibio-tarsal articulation reaching tympanum; tibia  $2\frac{1}{2}$  to  $2\frac{3}{4}$  times in length from snout to vent; two phalanges of fourth toe free; no dorso-lateral fold ..... *R. virgatipes*, Cope.
- Head broader than long; tibio-tarsal articulation reaching tympanum or eye; tibia 2 to  $2\frac{1}{2}$  times in length from snout to vent; fourth toe webbed to the tip, or last phalanx free; usually a more or less distinct dorso-lateral fold ..... *R. montezumæ*, Baird.
- B. Glandular dorso-lateral fold very distinct, extending to the hip (exceptionally interrupted posteriorly); nasal bones widely separated from each other.
1. Outer metatarsals separated nearly to the base; toes obtusely pointed,  $\frac{2}{3}$  to nearly entirely webbed; tibio-tarsal articulation reaching eye, tip of snout, or a little beyond; tibia  $3\frac{1}{2}$  to  $5\frac{1}{2}$  times as long as broad,  $1\frac{2}{3}$  to  $2\frac{1}{3}$  times in length from snout to vent.
- a. Male with vocal sacs.
- Head as long as broad or a little broader or a little longer; interorbital space much narrower than upper eyelid; dorso-

- lateral folds narrow or moderately broad, usually with interrupted folds or elongate warts between them; outer metatarsal tubercle absent or very indistinct; male with external or internal vocal sacs..... *R. halecina*, L.
- Head as long as broad; interorbital space much narrower than upper eyelid; dorso-lateral folds very broad, with a pair of similar folds between them; outer metatarsal tubercle usually present; male with internal vocal sacs .. *R. palustris*, Leconte.
- b. Male without vocal sacs.
- Head broader than long; interorbital space as broad as or narrower than upper eyelid; tympanum  $\frac{3}{4}$  to once diameter of eye; outer metatarsal tubercle absent or very indistinct ..... *R. draytoni*, B. & G.
- Head as long as broad or slightly broader than long; interorbital space narrower than upper eyelid; tympanum  $\frac{3}{4}$  to  $\frac{1}{2}$  diameter of eye; a more or less distinct outer metatarsal tubercle ..... *R. aurora*, B. & G.
2. Web not penetrating beyond basal half of outer metatarsals.
- a. Glandular dorso-lateral fold narrow or moderately broad; head moderately large; vomerine teeth on a level with or behind posterior borders of choanæ.
- Tibio-tarsal articulation reaching tympanum or eye; tibia 3 to  $4\frac{1}{2}$  times as long as broad, 2 to  $2\frac{1}{2}$  times in length from snout to vent; toes  $\frac{2}{3}$  to nearly entirely webbed; inner metatarsal tubercle  $\frac{1}{4}$  to  $\frac{1}{3}$  length of inner toe; male without vocal sacs ..... *R. pretiosa*, B. & G.
- Tibio-tarsal articulation reaching tympanum or eye; tibia 3 to 4 times as long as broad,  $2\frac{1}{2}$  to  $2\frac{3}{4}$  times in length from snout to vent; toes  $\frac{2}{3}$  to  $\frac{3}{4}$  webbed; inner metatarsal tubercle  $\frac{1}{4}$  to  $\frac{1}{3}$  length of inner toe; male with internal vocal sacs ..... *R. cantabrigensis*, Betd.
- Tibio-tarsal articulation reaching beyond eye; tibia 4 to 5 times as long as broad,  $1\frac{1}{2}$  to 2 times in length from snout to vent; toes  $\frac{2}{3}$  to  $\frac{1}{2}$  webbed; inner metatarsal tubercle  $\frac{2}{3}$  to  $\frac{1}{2}$  length of inner toe; male with internal vocal sacs ..... *R. silvatica*, Leconte.
- b. Glandular dorso-lateral fold broad; vomerine teeth between the choanæ.
- Head moderate, slightly broader than long, 3 to  $3\frac{1}{2}$  times in length to vent; loreal

- region feebly oblique; tibio-tarsal articulation reaching eye; tibia  $4\frac{1}{2}$  to 5 times as long as broad,  $2\frac{1}{4}$  to  $2\frac{1}{2}$  times in length from snout to vent; toes  $\frac{1}{2}$  webbed; male without vocal sacs .... *R. godmani*, Gthr.
- Head very large, as long as broad or a little broader than long,  $2\frac{3}{4}$  to 3 times in length to vent; loreal region very oblique; tibio-tarsal articulation reaching anterior border of eye or between eye and nostril; tibia 4 to 5 times as long as broad,  $1\frac{1}{4}$  to nearly 2 times in length from snout to vent; toes  $\frac{1}{2}$  webbed; male with external vocal sacs. *R. areolata*, B. & G.
- Head very large, much broader than long,  $2\frac{1}{4}$  to  $2\frac{3}{4}$  times in length to vent; loreal region very oblique; tibio-tarsal articulation reaching tympanum or eye; tibia 3 to  $3\frac{1}{2}$  times as long as broad, 2 to  $2\frac{1}{4}$  times in length from snout to vent; toes  $\frac{1}{2}$  webbed; male with external vocal sacs ..... *R. capito*, Leconte.
- II. Toes ending in very small discs; outer metatarsals separated nearly to the base; interorbital space equal to or a little less than breadth of upper eyelid; nasal bones widely separated from each other.
- A. Loreal region moderately oblique; toes entirely webbed or two phalanges of fourth free.
1. Tips of fingers swollen; vomerine teeth behind level of choanæ; tympanum  $\frac{1}{2}$  to  $\frac{2}{3}$  diameter of eye; tibio-tarsal articulation reaching tip of snout or beyond; head broader than long.
- No dorso-lateral fold; tympanum distinct; heels not overlapping; tibia  $1\frac{1}{2}$  to 2 times in length from snout to vent; no outer metatarsal tubercle; male without vocal sacs, ..... *R. tarahumaræ*, Blgr.
- Dorso-lateral fold, if distinct, very broad and flat and restricted to the anterior half of the body; tympanum feebly distinct, ill-defined; heels overlapping; tibia  $1\frac{1}{2}$  to 1; times in length from snout to vent; an outer metatarsal tubercle; male with internal vocal sacs ..... *R. boylii*, Baird.
- A moderately prominent dorso-lateral fold, extending to the hip, its distance from its fellow, on the back,  $3\frac{1}{2}$  times in length from snout to vent; tympanum very distinct; heels overlapping; tibia  $1\frac{1}{2}$  times in length from snout to vent; no outer metatarsal tubercle ..... *R. pustulosa*, Blgr.

2. Tips of fingers obtuse or rather pointed; vomerine teeth between choanae; tympanum  $\frac{1}{2}$  to  $\frac{3}{4}$  diameter of eye; tibio-tarsal articulation reaching eye or tip of snout; tibia  $1\frac{1}{2}$  to 2 $\frac{1}{2}$  times in length from snout to vent; dorso-lateral fold prominent, its distance from its fellow, on the back, 4 to 6 $\frac{1}{2}$  times in length from snout to vent; no outer metatarsal tubercle; head as long as broad or a little broader than long; male with internal vocal sacs . . . *R. palmipes*, Spix.
- B. Loreal region vertical or nearly so; toes  $\frac{1}{2}$  to  $\frac{3}{4}$  webbed; tips of fingers swollen; tympanum  $\frac{1}{2}$  to  $\frac{3}{4}$  diameter of eye; tibio-tarsal articulation reaching eye or between eye and tip of snout; heels overlapping; tibia 5 to 6 times as long as broad,  $1\frac{1}{2}$  to 2 times in length from snout to vent; dorso-lateral fold prominent, its distance from its fellow, on the back, 5 to 6 times in length from snout to vent; no outer metatarsal tubercle; head as long as broad or a little longer than broad; male without vocal sacs . . . . . *R. caeruleopunctata*, Sidr.

The American frogs all belong to the subgenus *Rana*, agreeing with the type-species, *R. temporaria*, L., in the structure of the pectoral arch (strong horizontal clavicles, omosternal style not forked at the base). I conceive the most primitive type as with large nasal bones in contact with each other and with the frontoparietals entirely covering the ethmoid; pointed, fully webbed toes with the outer metatarsals separated by web to the base; a distinct tympanum; no glandular dorso-lateral fold\*. I therefore regard the species grouped together in division I. A. of the above synopsis as nearest to this prototype; from this group I. B. 1. and II. seem to be directly and independently derived, probably also I. B. 2. b.; whilst I. B. 2. a. is obviously connected with I. B. 1. The species under Division II. are furthest removed from the prototype; I see no reason for regarding *R. boylii* as nearly allied to the *Rana temporaria*, and it is connected with *R. palmipes* by *R. pustulosa*.

#### 1. *Rana catesbiana*, Shaw, 1802.

*R. boans* (non L.), Lacep., 1788.—*R. mugiens*, Merr., 1820.—*A. scapularis*, pipiens, Harl., 1825.—*R. conspersa*, Leconte, 1855.

North America east of the Rocky Mountains, from Canada (Quebec, Ontario) to Florida and Texas.

#### 2. *Rana grylio*, Stejneger, 1901.

Florida, Mississippi, and Louisiana.

\* Cf. Bull. Soc. Zool. France, 1918, p. 111.

3. *Rana septentrionalis*, Baird, 1855.

*R. sinuata*, Baird, 1855.

Southern Canada and New York to Montana and Utah.

4. *Rana clamitans*, Daud., 1801.

*R. clamata*, Daud., 1803.—*R. fontinalis*, Leconte, 1825.—*R. flaviviridis*, Harl., 1825.—*R. horicomensis*, Holbr., 1842.—*R. nigricans*, Agass., 1850.—*R. nigrescens, clamator*, Leconte, 1855.—*R. clamitans melanota*, Rhoads, 1895.

North America, east of the Rocky Mountains, from Canada (Quebec, Ontario) to Florida and Louisiana.

5. *Rana onca*, Cope, 1875.

*R. draytoni onca*, Cope, 1889.—*R. fischeri*, Stejneger, 1893.

Utah and Nevada.

6. *Rana virgatipes*, Cope, 1891.

New Jersey (Atlantic City and Lakehurst) and North Carolina (Lake Ellis).

7. *Rana montezumæ*, Baird, 1855.

*R. adrita*, Troschel, 1865.—*R. montezumæ concolor*, Cope, 1887.

Platcan of Mexico, Tabasco, Tehuantepec.

8. *Rana halcina*, L., 1766 \*.

*R. pipiens*, Schreb., 1782.—*R. utricularia*, Harl., 1825.—*R. oxyrhynchus*, Hallow., 1856.—*R. berlandieri*, Baird, 1859.—*R. forreri*, Boulenger, 1893.—*R. vivescens*, Garm., 1884.—*R. halcina sphenoccephala*, *brachycephala*, *austriicola*, Cope, 1886.—? *R. trilobata*, Mocquard, 1899.—*R. omiltemana*, Günth., 1900.

North America as far north as 52°, not extending west of the Sierra Nevada, Mexico and Central America as far south as Costa Rica. Up to 8000 ft. altitude in Colorado, 8500 ft. in Mexico, 5000 ft. in Costa Rica.

It may be possible to define three principal varieties: *sphenoccephala*, Cope, *forreri*, Blgr., and *austriicola*, Cope (*leontii*, Gthr., *Brocchi*, *nigricans*, *Brocchi*).

\* This name, latinised by Linnæus from Kalin's 'Sillhoppertosser,' appears in the synonymy of *R. ocellata*.

9. *Rana palustris*, Leconte, 1825.*R. pardalis*, Harl., 1825.

North America, east of the Mississippi.

10. *Rana draytonii*, B. & G., 1852.*R. lecontei*, B. & G., 1853.—*R. nigricans*, Hallow., 1854.—*R. longipes*, Hallow., 1859.—*R. aurora draytonii*, Camp, 1917.

Western North America, from British Columbia to the mountains of Lower California, up to 4000 ft. altitude.

11. *Rana aurora*, B. & G., 1852.*R. temporaria aurora*, Cope, 1883.—*R. agilis aurora*, Cope, 1886.

Washington Territory, Oregon, and California.

12. *Rana pretiosa*, B. & G., 1853.*R. temporaria pretiosa*, Cope, 1889.—*R. pretiosa luteiventris*, H. B. Thoms., 1913.

North America, from the Rocky Mountains westwards, from British Columbia to California.

13. *Rana cantabrigensis*, Baird, 1854.*R. cantabrigensis latiremis*, evittata, Cope, 1886.

Western North America, from Alaska and Great Bear Lake to British Columbia, Alberta, Assiniboia, Manitoba, Minnesota, and Illinois.

14. *Rana silvatica*, Leconte, 1825.*R. pennsylvanica*, Harl., 1825.

Eastern North America, from Manitoba, Ontario, and Quebec to South Carolina.

15. *Rana godmani*, Gthr., 1900.

Costa Rica (Rio Suco).

I cannot help thinking that *R. godmani* will prove to be

identical with *Levirana vibicaria*, Cope, 1894. Except for the presence of feebly developed vomerine teeth, the longer inner finger, and the more extensive palmation of the toes in the former, there is almost complete agreement between the descriptions of the two, which are from the same part of Costa Rica.

16. *Rana areolata*, B. & G., 1852.

*R. circulosa*, Rice & Davis, 1878.

Indiana, Illinois, Georgia, Texas.

17. *Rana capito*, Leconte, 1855.

*R. areolata æsopus, capito*, Cope, 1886.

Georgia, Florida.

18. *Rana tarahumaræ*, Blgr., 1917.

Sierra Tarahumari, N.W. Mexico, about 3000 ft.

19. *Rana boylei*, Baird, 1854.

*R. pachyderma*, Cope, 1883.—*R. boylei muscosa, sierræ*, Camp, 1917.

Oregon and California, up to 11,500 ft. altitude.

20. *Rana pustulosa*, Blgr., 1883.

Ventanas in Durango, Mexico.

21. *Rana palmipes*, Spix, 1824.

*R. juninensis*, Tschudi, 1845.—*Ranula gollmeri*, Peters, 1859.—*R. clamatæ*, var. *guianensis*, Peters, 1863.—*Ranula affinis*, Cope, 1866.—*Pohlia palmipes*, Steind., 1867.—*Ranula brevipalmata, nigrilatus*, Cope, 1874.—*R. vaillanti*, Brocchi, 1877.—*Hylarana brevipalmata*, Brocchi, 1882.—*R. copit*, Bouleng., 1882.—*R. bonaccana, melanotoma*, Günth., 1900.—*R. brevipalmata rhoadsi*, Fowler, 1913.

Central and South America, from Southern Mexico to Pernambuco and Peru.

This frog is interesting as the only representative of the genus *Rana* in South America. Few species have been more misunderstood and have given rise to more discussion



than this *R. palmipes*, originally described from the Amazonian region of Brazil.

It has been made the type of a distinct genus (*Ranula*, *Pohlia*) by Peters and by Steindachner, and even referred to the *Hylidæ* by Günther (1867). Peters founded the genus *Ranula* on the feeble dentition: "Die Zähne des Oberkiefers sind so schwach und wenig zahlreich dass man sie erst bei genauer Untersuchung findet und am Gaumen fehlen sie ganz." The explanation is that *Ranula gollmeri* was described from a recently transformed young, from Caracas, measuring 50 mm. from snout to vent; of this I feel sure, having examined young from Pebas of exactly the same size with a short tail and toothless upper jaw. A second, larger specimen, also from Caracas, was described at the same time by Peters as *Rana affinis*, and regarded as so closely related to *R. temporaria* that it should perhaps rank as a local variety only. A little later, however, Peters recognized that the two supposed species were identical and correctly referred them to *R. palmipes*. In 1866, Cope took up the genus *Ranula* and defined it as the American representative of *Hylorana*, differing in the "important particulars of the incompleteness of the ethmoid arch, its superior plate being represented by cartilage." Cope, who maintained the definition up to the close of his labours, can only have examined young specimens, for in the adult the ethmoid is ossified exactly as in *Rana temporaria*.

Schlegel, Tschudi, and Duméril and Bibron referred *R. palmipes* to the synonymy of *R. esculenta*; Peters described another specimen as a variety of *R. clamitans*; Brocchi's *R. vaillanti* was described as allied to *R. mugiens*; whilst Günther (1900), overlooking the small terminal discs of the toes, compared his *R. bonaccana* to *R. clamitans* and *R. draytonii*.

## 22. *Rana cæruleopunctata*, Stdr., 1864.

*Ranula cæruleopunctata*, *chrysoprasina*, Cope, 1866.—*Hylarana cæruleopunctata*, Steind., 1867.—*Trypheropis chrysoprasinus*, Cope, 1868.—*Hylarana chrysoprasina*, Brocchi, 1882.

Nicaragua and Costa Rica, up to 4600 ft. altitude.

XLI.—*A remarkable Cysticercus from a rare Dolphin*  
(*Cysticercus Tæniæ Grimaldii*, Moniez, 1889). By H. A.  
BAYLIS, M.A.

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IN May 1917 a specimen of the rare dolphin *Lagenorhynchus acutus* was stranded at Skegness, on the Lincolnshire coast. It was sent to the British Museum (Natural History), and during its dissection by Mr. W. P. Pycraft there were found under the peritoneum large numbers of cysts. These contained blood-stained fluid, and in each of them, lying free in the fluid, was what appeared to be a *Cysticercus*. In some cases there were also two or three hard calcareous concretions in the fluid, and in one cyst the fluid was milky and opaque.

A number of the cysticerci were carefully preserved by Dr. W. T. Calman, to whom I am indebted for the foregoing details of information. Dr. Calman also observed that on removal from the host (which had been dead at least eleven days\*) the worms still showed signs of life, and "responded by feeble but quite distinct contractions when prodded with a needle."

The worm appears to be identical with a form described by Moniez (1889) under the name of "*Cysticercus Tæniæ Grimaldii*"\*, the sexually mature form of which is unknown. Although Moniez observed the most striking feature of the animal—viz., its long neck—he does not describe the anatomy very fully, and gives no account of the important characters of the scolex. Further, no figures of this remarkable form are given. It is thought worth while, therefore, to give here a somewhat fuller description, including some account of the scolex, which has features of systematic value.

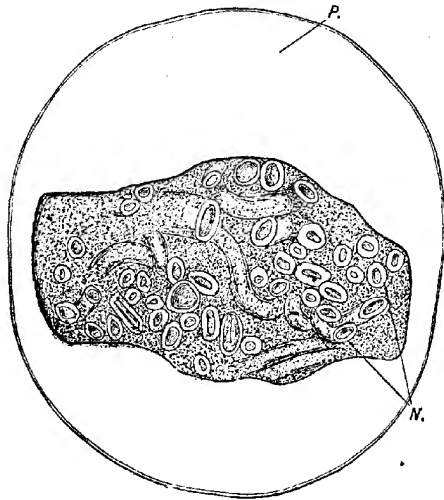
#### ANATOMY.

The cysticerci are yellowish-white in colour (in spirit) and are of very variable size and shape. The length varies from about 8 to 25 mm., according to age and state of contraction.

\* The *Cysticercus Tæniæ Grimaldii* is apparently closely similar to, if not identical with, *Stenotenia delphini*, Gervais, 1870; from this author's description it appears that he took the "neck" to be the worm itself, and the bladder of the cysticercus to be a second cyst containing it.

On the whole, the general form may be described as an elongate pear-shape, the narrower end being that at which the invagination takes place for the formation of the scolex. Frequently the "bladder" is somewhat flattened and pushed in on one side, so that the animal is then convex on one surface and concave on the other. The "anterior" end, or that at which invagination takes place, is often suddenly narrowed, forming a rather proboscis-like projection. The

Fig. 1.



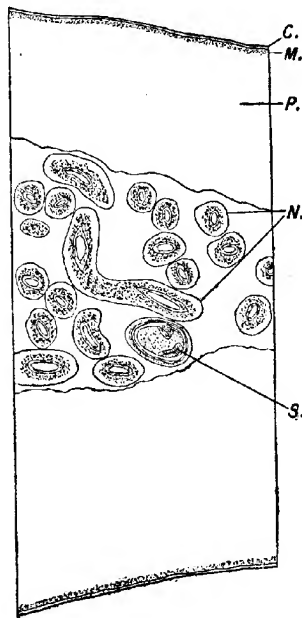
"*Cysticercus Teniae Grimaldii*." View of the animal cut through transversely at about the middle. Much magnified.

N., coils of the "neck" cut across in various directions; P., parenchyme of the "bladder."

wall of the bladder is firm in consistency, but cuts very easily. On opening a specimen, the wall is found to be very thick on two sides and comparatively thin on the other two (fig. 1, P.). The appearance of a small specimen on being thus opened is much like that of the well-known forms of *Cysticercus*, such as *C. pisiformis*, except as regards the

unusual thickness of the wall of the bladder. The larger specimens, however, show a very remarkable structure. The cavity of the bladder is almost entirely filled by an enormously long coiled tube, which on further investigation is

Fig. 2.



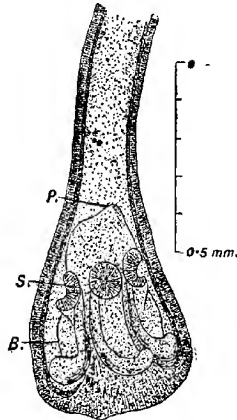
"*Cysticercus Tenia Grimaldii*." Portion of a transverse section near the hinder end, passing through the scolex.

C., cuticle; M., muscle-layers; N., coils of the "neck" cut across; P., parenchyme of the "bladder"; S., scolex.

found to be continuous at one end with the wall of the bladder at the point of invagination, and at the other end by careful search may be seen to end blindly in a slight bulbous expansion which contains a scolex. The tube, in fact, is

simply an extraordinarily elongated "neck," precociously developed within the bladder of the cysticercus. The coils of this tube run in various directions (figs. 1 & 2, *N.*), but in the main antero-posteriorly. After fixation of the worm it is impossible to straighten out this neck for the purpose of measuring it; but Moniez calculated that in one moderate-sized specimen examined by him it measured 65 centimetres, and the length was probably greater still in larger specimens. It must, at all events, be many inches in length.

Fig. 3.



"*Cysticercus Tenia Grimaldii*." The scolex, as seen by transparency within the swollen blind end of the "neck."

*B.*, bothridium; *P.*, terminal papilla; *S.*, accessory sucker.

The structure of the scolex (fig. 2, *S.*, & fig. 3) is especially important. Moniez dismisses it with the statement that it is provided with four suckers and destitute of hooks. In reality, however, its suckers deserve special attention. They are, strictly, "bothridia" of the type seen in certain Cestodes of the family Phyllobothriidæ—i. e., they have the form of elongated flaps (fig. 3, *B.*) attached to the scolex at their anterior ends and hanging freely posteriorly. Their edges are slightly curled inwards at the sides and behind,

forming a shallow cup. At the anterior end of each bothridium there is a small rounded muscular "accessory sucker" (fig. 3, *S.*). The apex of the scolex bears a slight papilla ("myzorhynchus") (fig. 3, *P.*), but there are no hooks of any kind. The scolex measures about 0.5 mm. in length and about 0.25 mm. in width at the level of the accessory suckers. The bothridia, including the accessory suckers, are about 0.3 mm. long, the diameter of the accessory suckers themselves being 0.1 mm. The neck, in a well-advanced specimen, measures 0.2 mm. in thickness and is of very nearly the same diameter throughout its length, though slightly widened here and there.

The histological structure of the animal presents some features of interest. The wall of the external "bladder," as has been mentioned, is greatly thickened, especially on two opposite sides. The groundwork of this thick envelope consists of loose parenchymatous tissue, with a few scattered muscle-fibres. There is a slight concentration of these towards the periphery, as seen in transverse sections, forming a vague circular layer. Externally the surface is covered with a delicate cuticle, immediately below which there is a thin coat of circular muscle-fibres, followed again by a thin coat of longitudinal muscles.

The parenchyme is densely crowded with calcareous bodies, showing the usual concentric structure. In addition to these there are immense numbers of fat-cells, each enclosing a large globule of fat. This fat is so abundant that it at first hindered the preparation of satisfactory serial sections, as it was found that a layer of it, partially dissolved out of the tissues by the xylol used in the process, was formed round the object when embedded in paraffin in the usual way. This difficulty was found to be easily overcome by a short immersion in ether before clearing. The fat-cells were very beautifully demonstrated by staining thin shavings of the parenchyme with Sudan III. and mounting in glycerine.

The parenchyme of the bladder-wall also contains numerous branching excretory vessels with delicate walls. These empty eventually into a wide and sinuous excretory canal, opening to the exterior by a minute pore at the posterior end of the bladder. This pore is, in some cases, just visible to the naked eye.

The structure of the long "neck" shows the same layers as have been described for the bladder, but in the reverse order, and they may be seen to pass over from one to the

other at the invagination. Thus the neck is lined by a thin cuticle, which is followed by two layers of muscles—the inner coat circular, the outer longitudinal. Outside the longitudinal muscles there is a coat of parenchymatous tissue, with very densely crowded nuclei on the inner side. The outer boundary of this layer, like the inner boundary of the wall of the bladder, is vaguely defined, and the parenchyme-cells seem to be bathed in the fluid contained in the bladder, which in the fixed material has become coagulated into a flocculent mass, containing numerous refringent granules.

#### SYSTEMATIC POSITION.

The structure of the scolex enables the affinities of this larval form to be decided with some precision. It may be assigned definitely to the genus *Monorygma*, Diesing, 1863, of the family Phyllobothriidæ. The question therefore arises whether it can be specifically determined. The worms of this genus, of which six species appear to have been described up to the present, are all parasitic, in their sexual stage, in sharks and dogfish.

The six known species are the following:—

1. *M. perfectum* (van Beneden, 1853) [*Anthobothrium perfectum*].  
Host: *Læmargus borealis*.
2. *M. gracile* (Olsson, 1869) [*Trilocularia gracilis*].  
Host: *Acanthias vulgaris*.
3. *M. elegans*, Monticelli, 1890 [originally described by Zschöke, 1889, under the name of *Monorygma perfectum*, Diesing].  
Hosts: *Seyllium catulus* and *S. stellare*.
4. *M. chlamydoselachi*, Lönnberg, 1898.  
Host: *Chlamydoselachus anguineus*.
5. *M. dentatum*, v. Linstow, 1907.  
Host: a shark (Antarctic) of unknown determination.
6. *M. rotundum*, Klaptocz, 1907.  
Host: *Notidanus* [*Hexanchus*] *griseus*.

As regards the dimensions of the scolex, the present form seems to approach most closely to *M. elegans*, which has been fairly fully described by both Zschokke\* (1889) and de Beauchamp (1905). The length of the scolex in this form is given by Zschokke as 0.4 mm.-0.8 mm., the width of the scolex as 0.3 mm.-0.4 mm., and the width of the neck as 0.1 mm.-0.25 mm. The other measurements given by both authors agree fairly well with those given above for the cysticercus.

There has been some confusion between *M. perfectum* (van Beneden) and *M. elegans*, but on comparing the original descriptions it seems highly probable, as Monticelli (1890, p. 434, footnote) and de Beauchamp (1905) contend, that the two forms are distinct. *M. elegans*, according to de Beauchamp, is 17 or 18 cm. in length, while *M. perfectum* reaches 30 to 40 cm. (van Beneden, 1853, 1861) or 12 to 15 inches (Diesing, 1863). The scolex is also very much larger in *M. perfectum*, measuring, according to van Beneden, 1-2 mm. in width, while Diesing gives it as  $\frac{1}{2}$ -1<sup>m</sup>. *M. perfectum* would appear therefore to be a considerably larger form altogether than *M. elegans*.

#### LIFE-HISTORY.

It would have been extremely interesting if the cysticercus under discussion could have been shown to belong to *Monorhyna perfectum*, since, as Dr. S. F. Harmer informs me, the host of this species, the Greenland shark (*Lamargus borealis*) has the habit of biting out pieces of the flesh of living Cetacea, and this would have afforded a satisfying account of the life-history of the parasite. If *M. elegans* and *M. perfectum* were shown to be identical, greater plausibility might be lent to this hypothesis. For the present, however, it seems impossible to assign the cysticercus definitely to any of the species. It may very possibly be that of *M. elegans*, which is parasitic in *Scyllium* spp., and to which species, as has been seen, it approaches closely in the size and structure of the scolex. We have also to remember the somewhat remarkable fact that the cysticerci can remain alive for at least eleven days after the death of the host, and even after its removal from the water. Hence they may very well be swallowed by any species of dogfish that devours pieces of dead dolphins containing the cysts.

\* Zschokke describes it under the name of *M. perfectum*, Dies.



As regards the long neck of the cysticercus, it would appear to be one of those apparently useless structures so frequently met with in the animal kingdom, of which no satisfactory explanation is forthcoming. As Moniez remarks: "Tout ce développement se fait en pure perte, car il est bien impossible que la tête du Ténia puisse se dévagner." In all probability all but the portion surrounding the scolex is thrown off and lost when the animal finds its way into its final host.

The host of the *Cysticercus Tenie Grimaldii*, Moniez, though its specific name is not given, would appear to have been the common dolphin (*Delphinus delphis*), as was also the host of Gervais's *Stenotenia delphini*. The worm is now recorded for the first time in *Lagenorhynchus*.

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XIII.—On Indo-Chinese Hymenoptera collected by R. Vitalis de Salvaza.—I. By ROWLAND E. TURNER, F.Z.S., F.E.S.

Family Siricidæ.

*Tremex smithi*, Cam.

*Tremex smithi*, Cam. Trans. Ent. Soc. London, p. 470 (1876). ♀ ♂.

One female, taken at Vieng Vai, Haut Mékong, on June 10, 1918, differs from the typical form in the total absence of yellow abdominal markings, in the more distinct blue gloss on the whole insect, and in the almost clear hyaline base of the wings, extending on the fore wing to the basal nervure and nervulus. I do not know whether these distinctions are merely individual or whether they indicate a local race. The antennæ are 22-jointed.

*Tremex flavicollis*, Cam.

*Tremex flavicollis*, Cam. Mem. Manchester Lit. & Phil. Soc. xliii. p. 3 (1899). ♀.

One female, taken at Vien Poukha, Haut Mékong, on May 11, 1918, differs from the description in having the scutellum covered with long fulvous hairs, and in having the fifth and sixth tergites broadly yellow at the base and clothed with long fulvous pubescence towards the apex. The antennæ are 21-jointed.

*Xiphydria melanopus*, Cam.

*Xiphydria melanopus*, Cam. Journ. Straits Br. R. As. Soc. xxxix. p. 93 (1903).

Hab. Nam Lot, Haut Mékong; May 2, 1918. 1 ♀.  
Described from Borneo.

Family Evanidæ.

*Pristaulacus tuberculiceps*, sp. n.

♀. Ferruginea; capite fusco-ferrugineo; antennis mandibulisque nigris; alis flavis, venis ferrugineis; cellula cubitali prima macula magna sub stigmate, cellula brachiali secunda striga obliqua basali, nervuloque macula oblonga venam basalem

attingente fuscis; cellula brachiali secunda apice leviter infuscata; capite maximo, vertice fortiter bituberculato.  
Long. 14 mm.; terebræ long. 12 mm.

♀. Mandibles broad, with two apical teeth, the outer one long, the inner one very short, above the inner tooth the edge of the mandible is broadly rounded. Second joint of flagellum about two and a half times as long as the first, third a little more than half as long again as the second. Clypeus rather sparsely punctured, front minutely and very closely punctured. Head massive, subquadrate, strongly produced behind the eyes, cheeks distinctly longer than the scape, temples distinctly broader than the eyes; posterior ocelli as far from each other as from the eyes and nearly three times as far from the hind margin of the head. Vertex produced posteriorly on each side into a large, upright, blunt tubercle. Behind each of the posterior ocelli, and separated from them by the same distance that separates them from the anterior ocellus, is a minute tubercle, which at first sight resembles a minute ocellus. Thorax without spines or tubercles; neck short; mesonotum and scutellum strongly transversely striated; praescutum concave in the middle anteriorly; mesopleuræ less strongly striated; postscutellum coarsely longitudinally striated, median segment coarsely and irregularly transversely striated, bluntly produced above the insertion of the abdomen. Tarsal ungues with a row of four teeth, excluding the apical tooth. Abdomen stout, the first segment very strongly broadened from the base, third and following tergites clothed with very delicate fulvous pubescence. Second abscissa of the radius half as long again as the first; second transverse cubital nervure incomplete; nervulus distinctly postfurcal; first recurrent nervure received by the first cubital cell at a distance equal to half the length of the first abscissa of the radius before the first transverse cubital nervure. Terebra and valvulæ black.

*Hab.* Vien Poukha, Upper Mekong (*R. Vitalis de Savaza*), May 11, 1918. 1 ♀.

Easily distinguished from other species of the genus by the extraordinary form of the head. *Aulacus bituberculatus*, Cam., has similar tubercles on the head, and is probably related to this species, though Cameron says that it belongs to *Aulacinus*, having three cubital cells.

## Family Ichneumonidæ.

## Subfamily Pimplinæ.

*Pimpla vitalisi*, sp. n.

♀. Nigra; palpis tegulisque pallide luteis; scutello macula mediana pallide flava; segmentis abdominalibus apice angustissime luteo-marginatis; pedibus anticis, intermediis, coxis exceptis, tibiisque posticis dimidio basali testaceis; alis subhyalinis, flavo-suffusis, stigmatibus venisque nigris.

Long. 18 mm.; terebræ long. 6 mm.

♀. Head transverse, narrowed behind the eyes; clypeus raised at the extreme base and punctured, strongly depressed from near the base and smooth; face closely punctured, with sparse fulvous hairs; front concave, shining and almost smooth, with a narrow longitudinal groove. Eyes widely, but very shallowly emarginate. Antennæ filiform, distinctly shorter than the whole insect, the third joint about half as long again as the fourth. Thorax stout, shining; the mesonotum minutely and very closely punctured; mesopleuræ and scutellum much more strongly and rather sparsely punctured; median segment coarsely and irregularly transversely striate, the sides of the segment rugose-striate, spiracles large, elongate-ovate. Abdomen longer than the head, thorax, and median segment combined, the five basal tergites strongly and very closely punctured-granulate; first tergite not carinate, strongly excavated at the base, the middle raised and obsoletely bituberculate; the three apical tergites minutely punctured; all the tergites narrowly transversely depressed at the apex, the depressed portion smooth and luteous. Valvulæ clothed with short hairs. Tarsal unguis not pectinate and without a basal tooth. Areolet subsessile, outwardly incomplete on the right wing, complete on the left. Nervulus distinctly postfurcal.

*Hab.* Pang Tiac, Haut Mékong; May 14, 1918.

Described from a single female.

Closely allied to the South Indian *P. apollyon*, Morl., but the stigma and veins are black, not fulvous as in *apollyon*, the front is more strongly concave and has a sulcus, the mesopleuræ are more strongly and sparsely punctured and the sculpture of the abdomen is coarser. *P. apollyon* is without luteous apical margins on the abdominal segments.

*Xylonomus vitiosus*, sp. n.

♀. Nigra, opaca; palpis, facie, orbitis late, propleuris fascia horizontali, mesonoto antice macula magna utrinque fasciaque obliqua utrinque postice, tegulis, mesopleuris macula lineaque ante alas, scutello macula mediana quadrata, maculaque parva basali utrinque, segmento mediano apice late, abdomine fere toto subtus, tergitis primo, secundo, tertioque macula magna laterali triangulari utrinque, fascia anguste apicali connectis, tergitis 4-7 fascia angusta apicali, pedibusque ochraceis; antennis ante apicem late albido cinetis; alis hyalinis, venis nigris.

Long. 16 mm.; terabræ long. 10 mm.

♀. Clypeus extremely short; face finely and very closely punctured; front more finely and sparsely punctured; vertex shining, with a few small scattered punctures. Antennæ about 26-jointed, the ten basal joints black, the next nine whitish, the remainder black. Pronotum produced on each side into an acute tubercle; mesonotum closely punctured, with a tendency to irregular reticulation, notauli deep and crenulate, the lateral lobes separated at the apex by a strongly margined longitudinal groove. Scutellum with a deep transverse excavation at the base, the excavation is smooth and shining and divided by a longitudinal carina, the median portion of the scutellum finely and closely punctured, the sides apically depressed and obliquely striated. Pleuræ closely punctured. Median segment with an elongate triangular basal area which is immediately followed by a larger cordate area reaching to the base of the apical truncation; the spaces on each side of the central areas divided by a transverse carina and margined by a carina laterally and apically, the apical angles produced into a strong spine; the dorsal surface of the segment finely and closely punctured. First tergite half as long again as the second, irregularly rugose-reticulate, the apical portion indistinctly transversely strigose and with a low longitudinal carina. Second and third tergites very closely punctured, the second feebly reticulate at the base, both with oblique striated depressions from close to the base to beyond the middle, also with another oblique depression laterally cutting off a triangular area at the basal angles, a rounded striated groove joining the lateral grooves apically to the median impressions. Apical tergites microscopically punctured. Hind tibiae black at the extreme base.

*Hab.* Sala San Tiôt, Luang Prabang; March 10, 1918.  
1 ♀.

Allied to *annulicornis*, Cam., and *elizabethæ*, Bingh., but differs in the absence of blue colouring, in the colour-pattern, in the shorter and broader second tergite, in the spines of the median segment and pronotum, in the contraction of the central area of the median segment, which in the other species is not divided into two, though narrowed in the middle, and in the shorter terebra.

#### Subfamily OPHIONINÆ.

##### *Dicamptus giganteus*, Szép.

*Dicamptus giganteus*, Szépligeti, Wytzman, Genera Insect. xxxiv. p. 28 (1906).

A single female of this fine species taken at Vieng Vai, Haut Mékong, on June 10, 1918, answers well to the description. The type was from Java.

#### Subfamily CRYPTINÆ.

##### *Vagenatha spinosa*, Cam.

*Vagenatha spinosa*, Cam. Proc. Zool. Soc. London, p. 41 (1901). ♀.

Hab. Pak Lay, Laos; August 2, 1918. 1 ♀.  
Described from Borneo.

#### Family Braconidæ.

##### Subfamily BRACONINÆ.

##### *Campyloneurus latesuturalis*, sp. n.

♀. Nigra; prothorace, mesonoto, scutello, mesopleurisque antice rufis; mandibulis, apice nigris, palpisque testaceis; sternitis flavo-ochraceis; alis fusco-hyalinis; stigmatibus venisque nigris. Long. 8 mm.; terebra long. 6 mm.

♀. Face closely punctured and covered with short grey hairs, longitudinally elevated below the base of each antenna. Front and vertex microscopically punctured, the front with a broad, smooth, longitudinal groove below the anterior ocellus. Temples fully half as broad as the eyes; head not narrowed behind the eyes, which are as far from the posterior margin of the head as from the anterior ocellus. Antennæ 47-jointed, about 6 mm. in length. Thorax and median segment shining; the middle lobe of the mesonotum minutely punctured; notauli smooth, extending almost to the posterior margin of the mesonotum. Median segment smooth on the dorsal surface, minutely punctured and

thinly clothed with long grey hairs on the sides. First tergite rugose, the raised median portion with a longitudinal carina, the lateral depressions transversely rugulose, the segment not much longer than its apical breadth. Second tergite as long as its basal breadth, coarsely longitudinally rugose, a median carina not reaching to the apex and dilated at the base into a small, smooth, triangular area; on each side from near the basal angles a longitudinal carina curved at the base extends nearly to the apex of the segment, outside these carinae the segment is irregularly obliquely striolate. Suture between the second and third tergites very broad, coarsely longitudinally striated; third tergite less coarsely and more closely longitudinally striated, fourth and fifth tergites punctured-rugose, crenulate at the apex. Hypopygium cultriform, extending beyond the anus. Valvulae covered with very short black hairs. Cubital nervure sharply elbowed close to the base; second abscissa of the radius almost as long as the third; recurrent nervure received just before the first transverse cubital nervure.

*Hab.* Tong King, Haut Mékong, April 13, 1918. 1 ♀.

This is related to "*Bracon*" *unbrutalis*, Cam., which occurs in the Khasi and Naga Hills, but the securiform articulation is much broader, the sculpture of the abdomen is coarser and different, and the median segment is smoother. The sculpture seems to be nearer to that of "*Bracon*" *firmus*, Cam., but Cameron does not mention the sculpture of the third tergite, and the calcaria in *firmus* are said to be white, not dark as in the present species.

#### Subfamily *Exothecinae*.

##### *Eumorpha vitalisi*, sp. n.

♀. Ferruginea; mandibulis apice, antennis, abdomine supra pedibusque nigris; mandibulis basi, facie, pedibusque anticis intermediisque flavo-ochraceis; abdomine subtus albido-flavo, nigro-maculato; alis flavis, tertio apicali infuscatis; venis apice fuscis; stigmato venisque basi ochraceis.

Long. 18 mm.; terebræ long. 21 mm.

♀. Face opaque, delicately punctured-rugulose, sparsely clothed with long fulvous hairs. Antennæ about 15 mm. in length, 107 jointed. Front smooth and shining, shallowly concave, with a low longitudinal carina; vertex shining, with small sparse punctures. Head slightly narrowed behind the eyes, which are nearly as far from the posterior margin of the head as they are from the anterior ocellus. Thorax smooth and shining; notauli shallow,

extending well beyond the middle of the mesonotum; median segment finely and rather closely punctured at the base, smooth at the apex, with a longitudinal median groove. Abdomen elongate, about half as long again as the head, thorax, and median segment combined, the four basal tergites longitudinally coarsely rugose-striolate; the first tergite coarsely obliquely striate on the basal half, nearly half as long again as its apical breadth, rather strongly convex in the middle, the lateral grooves indistinctly transversely striated. Second tergite with a feebly convex and strongly longitudinally striated, but ill-defined, triangular basal space reaching to the middle; the spaces at the anterior angles small, divided from the rest of the tergite by a smooth oblique groove, the tergite nearly as long as its apical breadth. Suture between the second and third tergites, also the two following sutures finely crenulate. Third and fourth tergites much broader than long; with large smooth areas at the basal angles nearly reaching the apical angles and bounded by a finely crenulated groove. Fifth tergite rugose in the middle, the remaining tergites minutely punctured. Valvulae clothed with short hairs which are black on the basal half, fulvous towards the apex; terebra with four ill-defined joints on its apical third. Nervulus strongly postfurcal; radial cell not quite reaching to the apex of the wing, second abscissa of the radius as long as the third, recurrent nervure interstitial.

*Hab.* Vieng Vai, Haut Mékong; June 10, 1918. 1 ♀.

This genus was described by Szépligeti from an Ethiopian species, *E. nigripennis*, Szép.

The present species agrees well in structural details with that insect, though the recurrent nervure is not interstitial in *nigripennis*. Both species show the curious jointed terebra. Superficially and in colour the present species resembles *Iphiaulax halyaetus*, Cam.

#### Subfamily AGATHINÆ.

##### *Cremnops mekongensis*, sp. n.

♀. Testacea; antennæ, tibiis posticis apice, tarsis posticis, terebra valvulisque nigris; alis flavo-hyalinis, venis flavis, vena basali macula ferruginea.

Long. 8 mm.; terebræ long. 3 mm.

♀. Rostrum very long; head smooth and shining, the front deeply excavated above the base of the antennæ, the excavation divided by a longitudinal carina; a few small punctures on the vertex. Mesonotum finely punctured, a



distinct longitudinal furrow on the anterior portion of the median lobe; notauli deep and finely crenulate, reaching almost to the posterior margin. Scutellum convex, shining, with sparse minute punctures; a deep, broad, transverse groove at the base, in which are three longitudinal carinæ. Median segment with two strong, parallel, longitudinal carinæ in the middle, on each side of which are two rather lower parallel carinæ, between the carinæ are lower transverse carinæ giving the segment a coarsely reticulate appearance; on a slightly lower level is an oblique lateral carina on each side just below the spiracle. Mesopleure sparsely and finely punctured. Abdomen smooth and shining. Hind legs strongly punctured and pubescent, tarsal ungues bifid. First abscissa of the radius shorter than the second; cubital nervure separating the first cubital and discoidal cells obsolete, except at the base; second cubital cell quadrate, the second transverse cubital nervure with a feeble angle above the middle. Radial cell reaching almost halfway from the apex of the stigma to the apex of the wing.

*Hab.* Vien Poukha, Haut Mékong, May 11, 1918. 1 ♀.

*Euagathis dubiosus*, sp. n.

♂. Flavo-testaceus; flagello, abdomine pedibusque posticis nigris; alis flavis, stigmatibus venisque flavis, macula parva prope basin stigmatibus nigra.

Long. 10 mm.

♂. Face finely punctured, with a short median depression below the base of the antennæ, the lamellæ between the antennæ small. Front only shallowly concave, the concave area without marginal carinæ, smooth and shining; vertex sparsely and very minutely punctured. Antennæ about 12 mm. in length. Mesonotum closely and finely punctured; the median lobe obliquely depressed anteriorly, with three low carinæ extending from the anterior margin to beyond the middle, the apex of the lobe beyond the carinæ smooth and shining; notauli deep, not crenulate. A deep, broad depression, in which are three longitudinal carinæ, at the base of the scutellum; postscutellum longitudinally striated. Median segment with a longitudinal carina above and another below the large elongate spiracle, the dorsal surface with a transverse basal depression and three almost parallel longitudinal carinæ, two oblique carinæ on each side from the basal depression almost reaching the lateral carina. Abdomen smooth and shining, a small transverse depression on each side at the base of the second segment. Hind legs very closely punctured; tarsal ungues bifid. Second cubital

cell almost pointed on the radius, the second transverse cubital nervure curved. Apex of the radial cell a little further from the apex of the wing than from the apex of the stigma.

*Hab.* Houei Sai, Haut Mékong, June 6-10, 1918. 1 ♂.

Possibly a form of *Agathis maculipennis*, Brullé, which it resembles in colour, but the second fuscous spot on the fore wing is absent in the present species. Brullé's description is not sufficient to indicate whether his species should be placed in *Euagathis* or *Disophrys*.

XLIII.—*A remarkable new Ball-rolling Beetle*  
(Family Scarabæidæ). By GILBERT J. ARROW.

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A SINGLE specimen of the extraordinary insect here represented, bearing no label to record its origin or habitat, was in the collection of the late B. G. Nevins, recently presented to the British Museum by his son. Probably, like its nearest allies, it inhabits the western part of Southern Africa, possibly the Bihé district of Angola, from which Mr. Nevins received other interesting beetles. The specimen is a male, and the great enlargement of the fore legs is no doubt distinctive of that sex. The enormously thickened front femora seem to indicate great muscular power, and the strangely shrunken intermediate legs appear more singular by contrast. The insect is a striking example of specialization by successive atrophy of its members. The front tarsi have disappeared in all the ball-rolling Scarabæidæ; the wings also have gone in the present genus, and here we seem to be advancing towards a reduction in the number of legs from six to four.

I refrain from establishing a new genus for this species in view of the unsatisfactory character of several of those at present recognized in the group. I can find no sufficient reason for separating *Pachysoma* and *Mnematum*. Although *M. silenus*, Gray, has the middle coxæ apart, the type-species, *M. richii*, has not, and the features relied upon by Macleay for its severance from *Pachysoma* have been found to have no importance. Similarly, there seems no adequate ground for separating *Mnematum* from *S-basteos*.

*Mnematum cancer*, sp. n.

Nigrum, nitidum, glabrum, corpus depressum, latissimum, capite antice 6-dentato, supra haud dense tuberculato, pronoto hic et illic minute punctato, lateribus serratis, basi leviter sinuato,

utrinque obtuse angulato; elytris brevissimis, subtiliter obsolete striatis, haud punctatis; pedibus anticis validissimis, femoribus fortiter incrassatis, antice acute tridentatis, coxis anticis etiam acute dentatis, tibiis elongatis, extus post medium dentibus sat brevibus 4 armatis, intus serratis, apice leviter incurvato, pedibus intermediis mirabilo reductis, tibiis brevibus, apice calcare spatulato munito, tarsis ad horum extremitates vix attingentibus, pedibus posticis modice elongatis, tibiis gracilibus, leviter arcuatis, apice calcaribus spatulatis quam tarsis dimidio brevioribus praeditis, extus hirtis nigris dense ordinatis bis cristatis, crista interiori integra, exteriori interrupta; unguibus minutis, haud curvatis aut divergentibus.

Long. 48 mm.; lat. max. 32 mm.

This has no close relationship with any other known species. Not only is it much larger, but the conformation of the legs is very different. Their hairy fringes are much



*Mnematium cancer*, sp. n., natural size.

shorter and more compact, and the swollen and strongly toothed front femora and the greatly reduced middle pair of legs have no counterpart in any other species. The shape of the head is as in the species of *Sebastos*, very broad and sparsely studded with tubercles. The pronotum is distinctly broader than the elytra and bears only a few small clusters of minute punctures. There is a short upturned fringe of hairs near the middle of the serrated lateral margins, which meet

the regularly curved basal margin in an obtuse angle on each side. The very short elytra are shining, like the pronotum, and show traces of fine striæ but no punctures. The pygidium is smooth but for a few scattered punctures. The front femora are almost like those of the male *Pachylomera femoralis*, having a tooth near the base connected by a serrated carina with one of the two sharp teeth situated near the articulation with the tibia, and the coxa is also toothed in front. The great broad front tibia is armed with four teeth along the anterior half of the outer edge, the inner edge is serrated and above it is an upturned fringe of short hairs, while the upper face has also two small brushes of similar hairs upon its anterior half. The middle and hind tibiæ each bear a blunt spatulate terminal spur, extending beyond the tarsus in the middle legs, but only half its length in the hind ones. The hind tibia has two parallel fringes of stiff hairs directed upwards, the inner one continuous and the outer interrupted. Both pairs of tarsi are rather broad and the claws are minute, short, straight, and not divergent.

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PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

December 4th, 1918.—Mr. G. W. Lamplugh, F.R.S.,  
President, in the Chair.

The following communication was read:—

‘The Carboniferous Succession of the Clitheroe Province.’ By  
Lt.-Col. Wheelton Hind, M.D., B.S., F.R.C.S., F.G.S., and  
Albert Wilmore, D.Sc., F.G.S.

The tectonic structure of the province consists of three dissected parallel anticlinal folds in beds of Carboniferous-Limestone, Pendle-side, and Millstone-Grit age. The general direction of the axes of these folds is east-north-east and west-south-west. Dissection has exposed the lower beds of Z, C, and S age, as the tectonic axes and beds of D, P, and Millstone-Grit age occur on the flanks.

The Limestone sequence shows all the zones from Z to D. *Modiola* and *Cleistopora* phases have not been exposed, the base of the Carboniferous not being seen. The Z beds are much thickened, and not so fossiliferous as in the Bristol Province. C and S beds are, as a rule, well-bedded, with shales intercalated between beds of limestone. There are crinoidal beds of considerable thickness in places, and shell-breccias are common in S. *Zaphrentis omaliusi* indicates an important horizon in Lower C, and these

beds are characterized by numerous large gasteropods. *Productus humerosus (sublævis)* marks an equally important horizon in Upper C, as it does in the Belgian Province.

D beds are peculiar in the western part of the Clitheroe Province, and are largely represented by shales, mudstones, and thin earthy limestones; but in the north and north-east, in the Settle and Burnsall districts, thick, fossiliferous, obscurely-bedded limestones with a rich brachiopod and molluscan fauna occur.

The Pendleside Series is well developed, and practically the whole sequence is exposed on the north-western flank of Pendle Hill. This series can be subdivided into life-zones by the Goniatites.

The lower 300 feet consists of well-bedded earthy limestones with much chert, characterized by the presence of *Prolecanites compressus*. As a rule, there is a well-marked limestone horizon, which the Authors name the Ravensholme Limestone (from a farm of that name at the north-eastern end of Pendle); this limestone contains *Zaphrentis amplexoides*, *Cyathaxonia ruskiana*, *Michelinia tenuisepta*, and *M. parasitica*, and the fauna is a very important and constant feature throughout the whole province. The Ravensholme Limestone is an important part of the 'Pendleside Limestone' of the late Mr. R. H. Tiddeman.

The Pendleside Limestone is succeeded by hard, black, calcareous shales with *Glyphioceras striatum*, *Nomismoceras rotiforme*, and *Posidonomya becheri*; and these in turn by the Bowland Shales of Phillips, which contain the zones of *Glyphioceras spirale* and *Glyphioceras bilingue*.

The Upper Pendle Grit succeeds the zone of *Glyphioceras bilingue*, and is the homotaxial equivalent of Farey's Grit of the Peak Country.

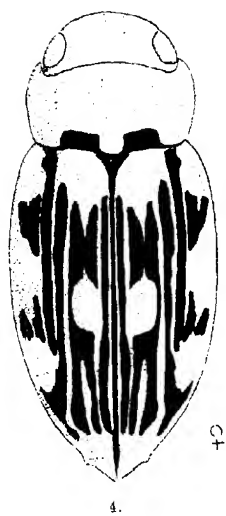
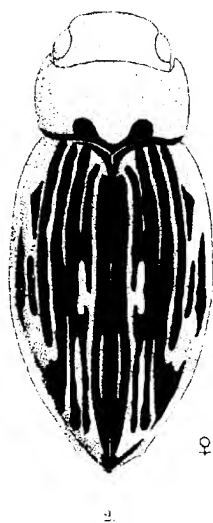
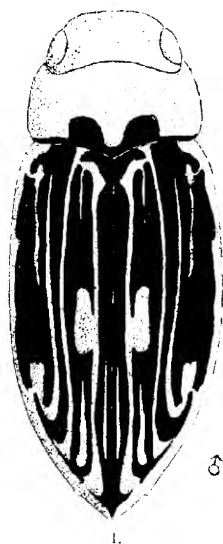
An important horizon occurs between the Kinder Scout and the Millstone Grit—Sabden Shales—characterized by a rich fauna with *Glyphioceras beyrichianum* and *Glyphioceras reticulatum*. It is considered probable that the well-known fossiliferous Hebden-bridge Beds may be on this horizon rather than in the Pendleside Series.

TABLE OF GONIATITE ZONES.

Zones of the Pendleside Series.	'Middle' Coal Measures.	<i>Gastrioceras carbonarium</i> von Buch.
	Lower Coal Measures.	<i>Gastrioceras carbonarium</i> von Buch.
	Upper Millstone Grit.	<i>Gastrioceras listeri</i> Martin.
	Sabden Shales.	<i>Glyphioceras diadema</i> Beyrich.
	Shales below Millstone Grit.	<i>Glyphioceras bilingue</i> Salter.
	Bowland Shales.	<i>Glyphioceras reticulatum</i> Phillips.
		<i>Glyphioceras spirale</i> Phillips.
		<i>Glyphioceras striatum</i> Phillips.
	<i>Posidonomya becheri</i> Shales.	<i>Nomismoceras rotiforme</i> Phillips.
		<i>Prolecanites compressus</i> Sowerby.
	Carboniferous Limestone D.	<i>Glyphioceras crenistria</i> Phillips.

TALFOUR-BROWNE.

*Ann. & Mag. Nat. Hist. S. 9, Vol. III, Pl. VII.*



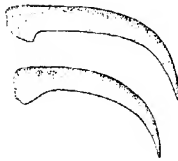




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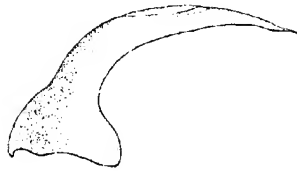
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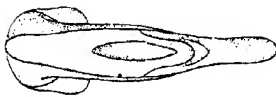
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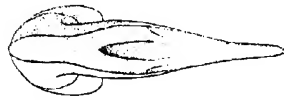
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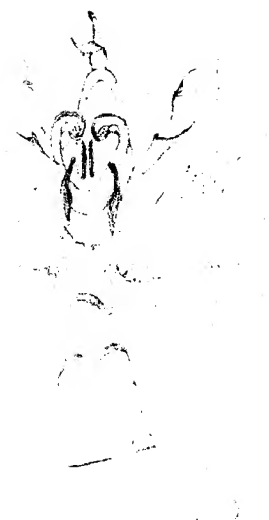




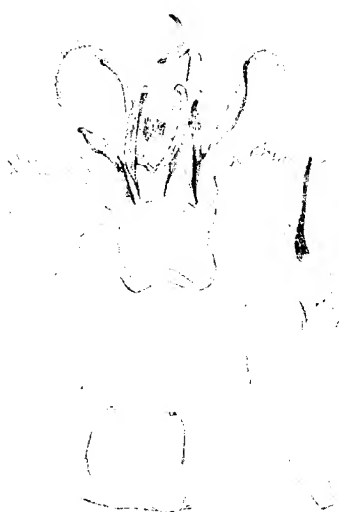
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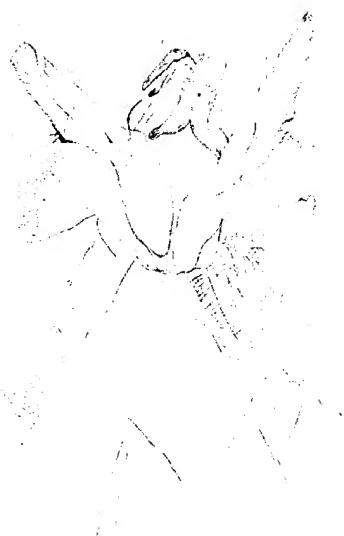


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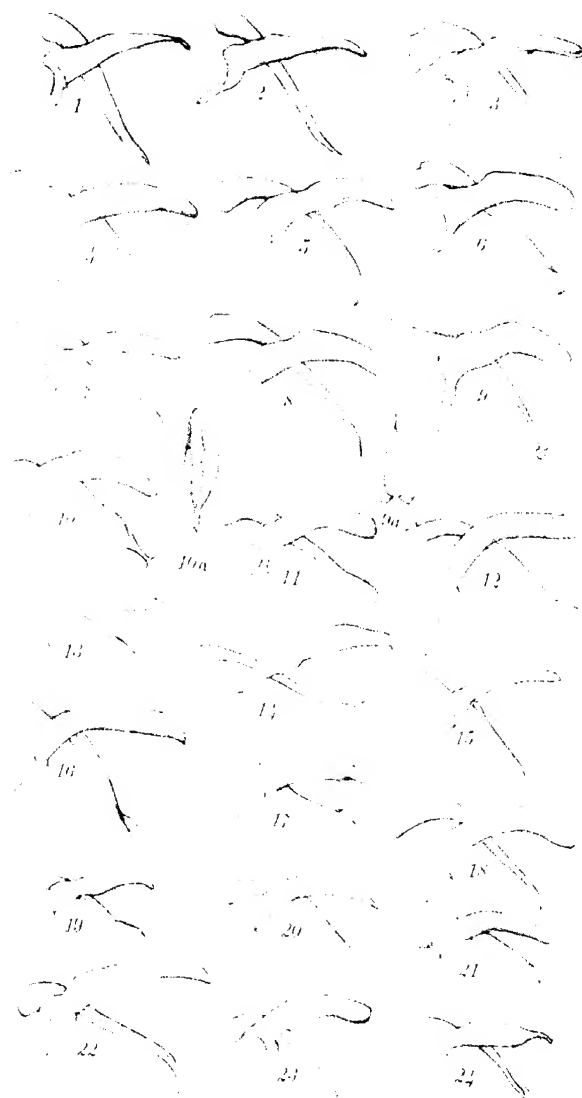
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*Illus. & grav. de.*

Figs. 1-24. Genital armature,  $\sigma$ , of species of *Prionoxerus* and *Idia*.





*Drawn by Knight, del.*

FIGS. 25-49. Genital armature, ♂, of species of *Ibana*.

FIG. 49A. Sixth ventral segment of *I. pallidicolor*, ♂.

FIG. 50. Apices of elytra of *I. nigrigera*, ♂.





